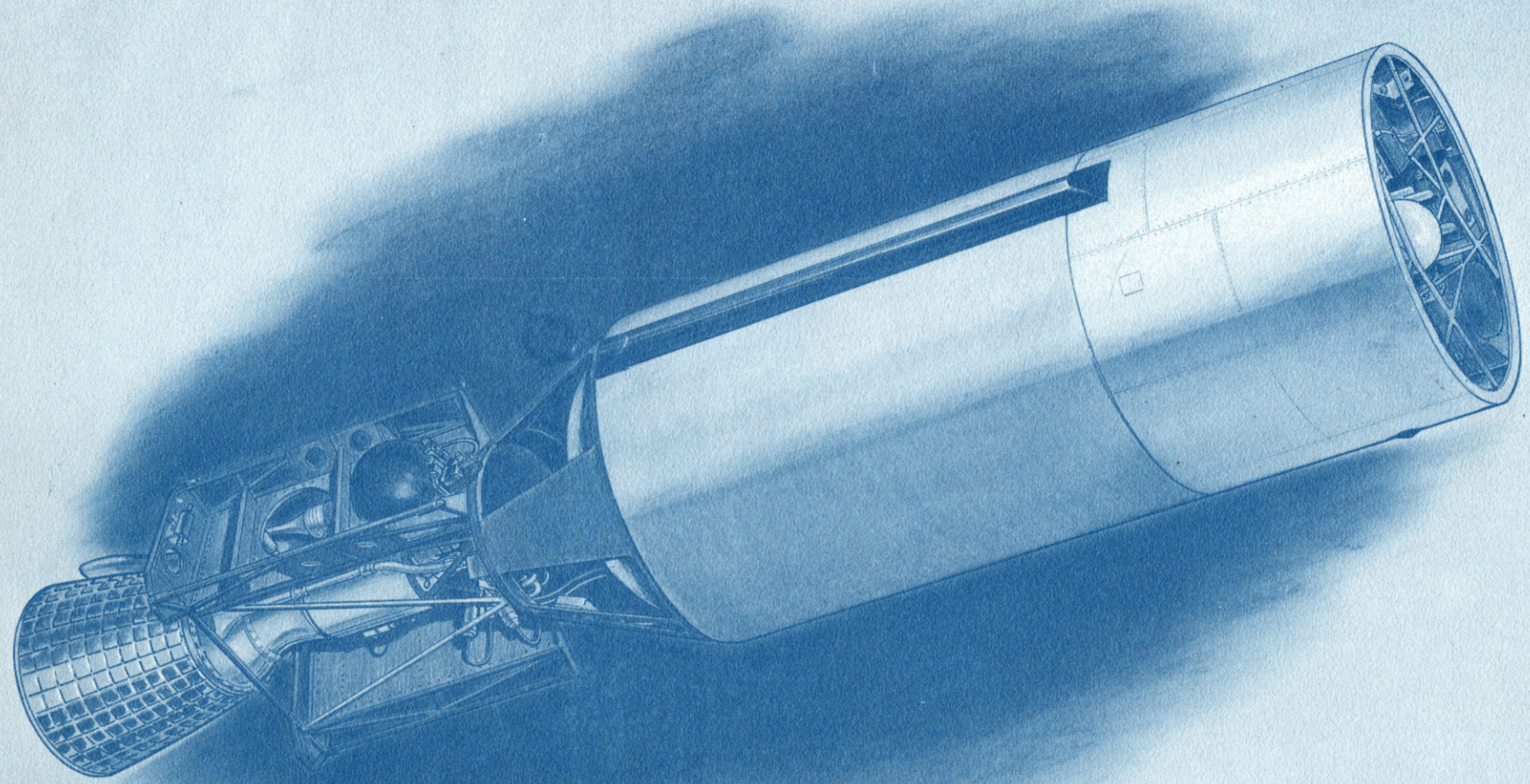
LMSC-A912348

AGENA ORIENTATION



LMSC-A912348
Code 9999
1 November 1967

AGENA SPACE VEHICLE ORIENTATION COURSE

LOCKHEED MISSILES & SPACE COMPANY
SPACE SYSTEMS DIVISION
SUNNYVALE, CALIFORNIA

31 OCTOBER 1967 – 1 NOVEMBER 1967

FOREWORD

THIS BROCHURE WAS PREPARED FOR THOSE ATTENDING THE AGENA ORIENTATION COURSE AS A READY REFERENCE TO COURSE CONTENT. FOR A DETAILED TECHNICAL DESCRIPTION OF THE AGENA, SEE "THE MULTIPURPOSE AGENA SPACECRAFT" BROCHURE AND "STANDARD AGENA SPACE VEHICLE MODEL SSOI-B" DESCRIPTION MANUAL.

ANY ADDITIONAL QUESTIONS SHOULD BE ADDRESSED TO:

C. F. HAGENMAIER
GENERAL MARKETING MANAGER
SPACE SYSTEMS DIVISION
LOCKHEED MISSILES & SPACE COMPANY
SUNNYVALE, CALIFORNIA 94088

PHONE: (408) 742-6855

ORDER OF PRESENTATIONS

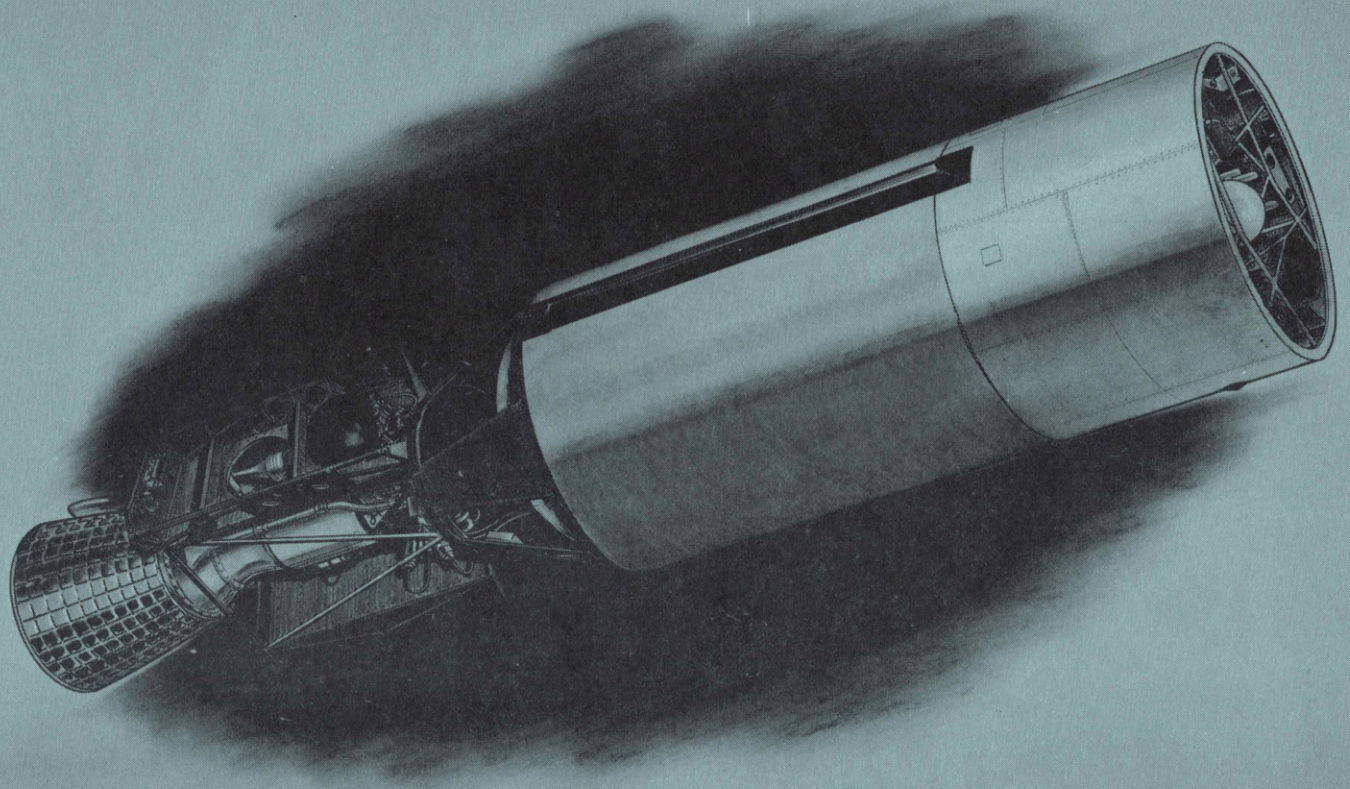
FIRST DAY

SUBJECT	PAGE
AGENA ORIENTATION	AO-1
AGENA HISTORY	H-1
AGENA VEHICLE SUMMARY	V-1
AGENA SPACEFRAME/SHROUDS	S-1
SYSTEMS OPERATIONS	SO-1
ELECTRICAL SYSTEM	E-1
COMMUNICATIONS AND CONTROL	CC-1
ON-ORBIT OPERATIONS	P-1

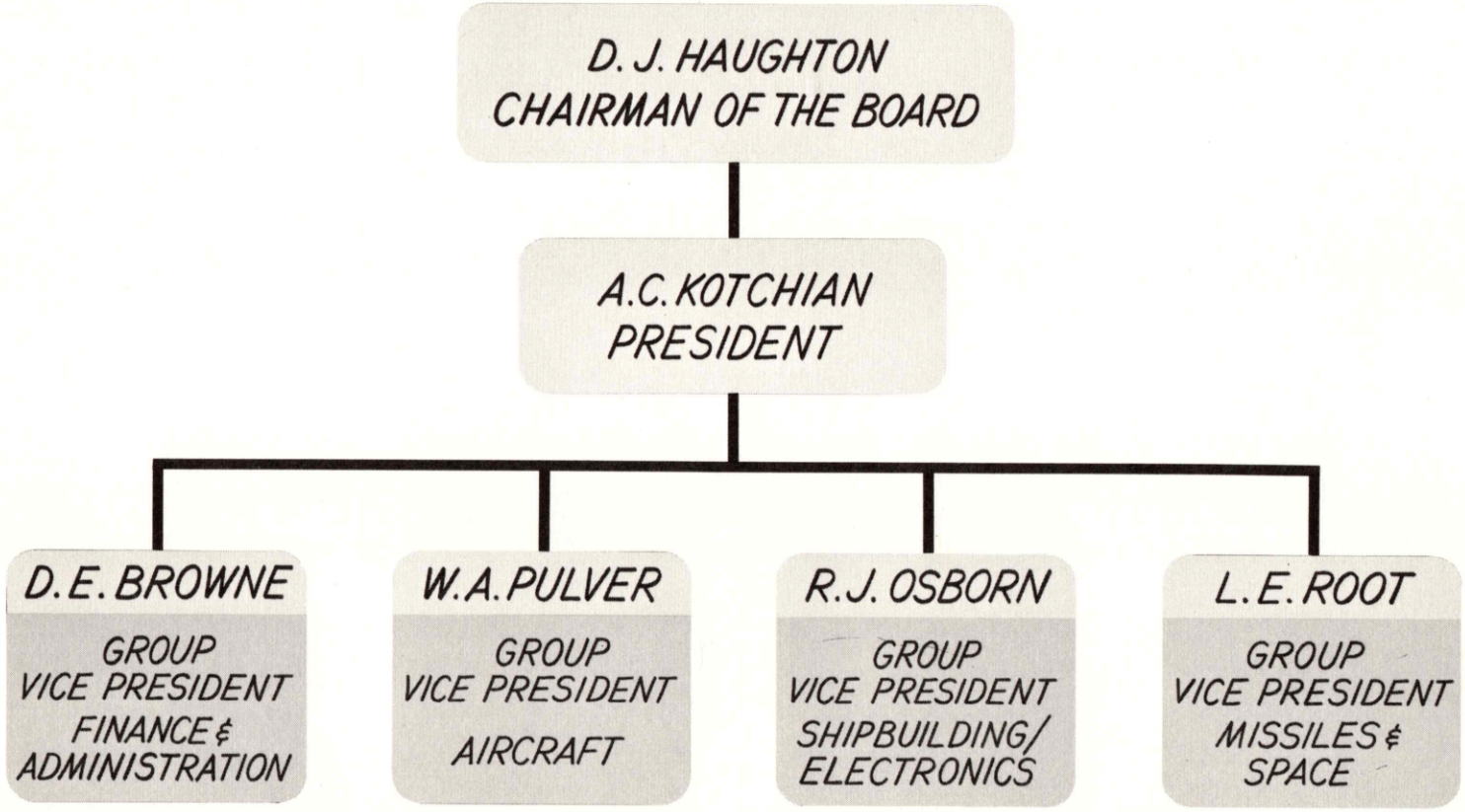
SECOND DAY

PROPULSION	P-1
GUIDANCE AND CONTROL	G-1
SPACEBORNE ANTENNAS	A-1
RELIABILITY	R-1
SPACE EXPERIMENTS CAPABILITY	SE-1
IMPROVED AGENA	IA-1
GROWTH PROJECTION	GP-1

AGENA ORIENTATION



LOCKHEED AIRCRAFT CORPORATION



LMSC ORGANIZATION

LOCKHEED MISSILES & SPACE COMPANY • A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION



L. E. ROOT
PRESIDENT
(GRP. VICE PRES.-LAC)



W. RIEKE
EXEC. VICE PRES.
(VICE PRES.-LAC)

SPACE SYSTEMS DIVISION



R. R. KEARTON
V. P. & GEN. MGR.
(VICE PRES.-LAC)



J. W. PLUMMER
V. P. & A.G.M.



R. D. KING
V. P. & A.G.M.



F. C. E. ODER
V. P. & A.G.M.



H. W. KOHL
V. P. & A.G.M.

MISSILE SYSTEMS DIVISION



S. W. BURRISS
V. P. & GEN. MGR.
(VICE PRES.-LAC)



R. A. FUHRMAN
V. P. & A.G.M.



C. C. PEARSON
V. P. & A.G.M.



D. A. STUART
V. P. & A.G.M.

RESEARCH & DEVELOPMENT DIVISION



E. P. WHEATON
V. P. & GEN. MGR.
(VICE PRES.-LAC)



J. P. NASH
V. P. & A.G.M.



G. H. PUTT
V. P. & A.G.M.



W. C. GRIFFITH
V. P. & A.G.M.

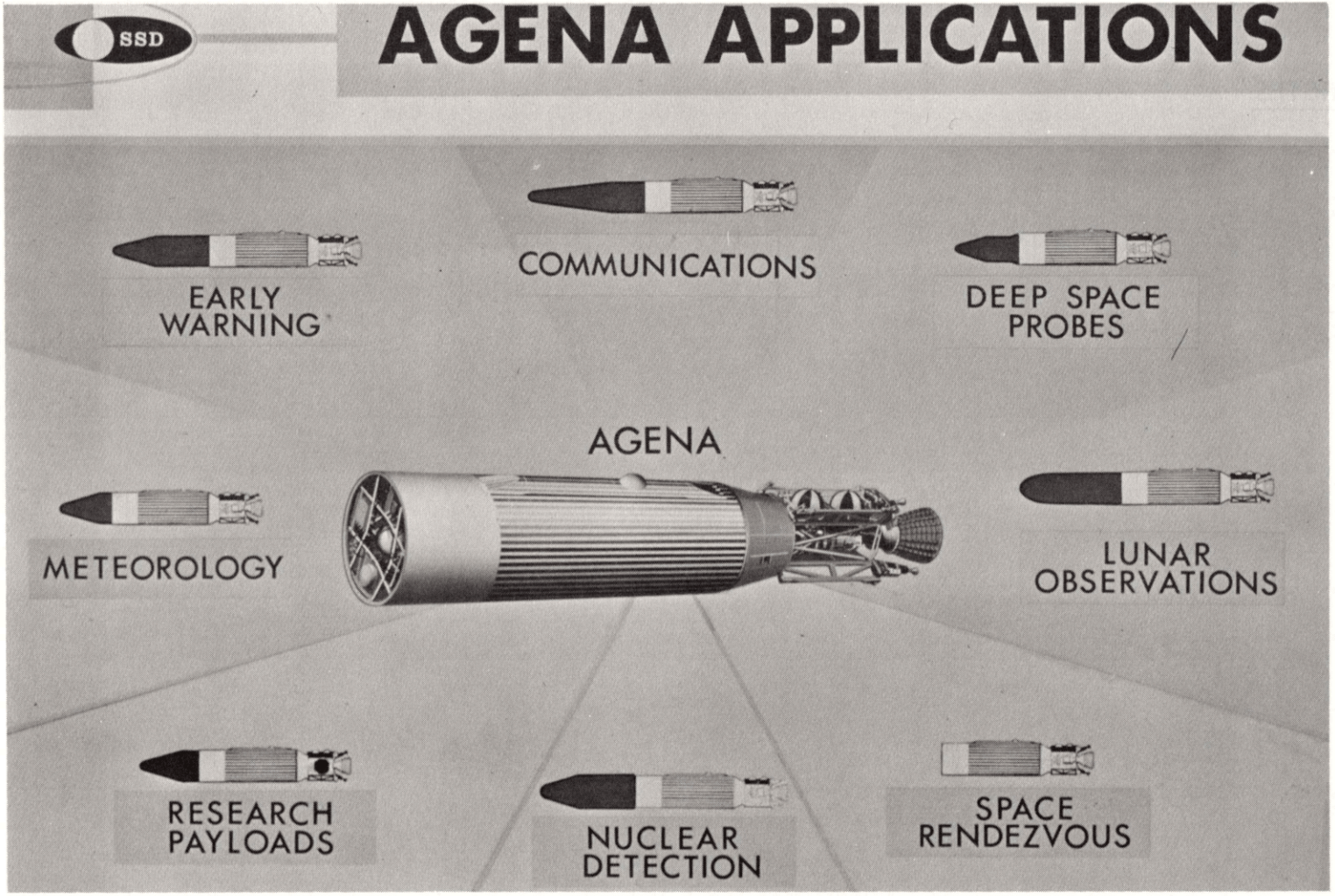


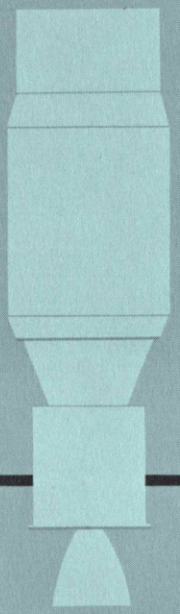
N. C. APPOLD
V. P. & A.G.M.

M1001

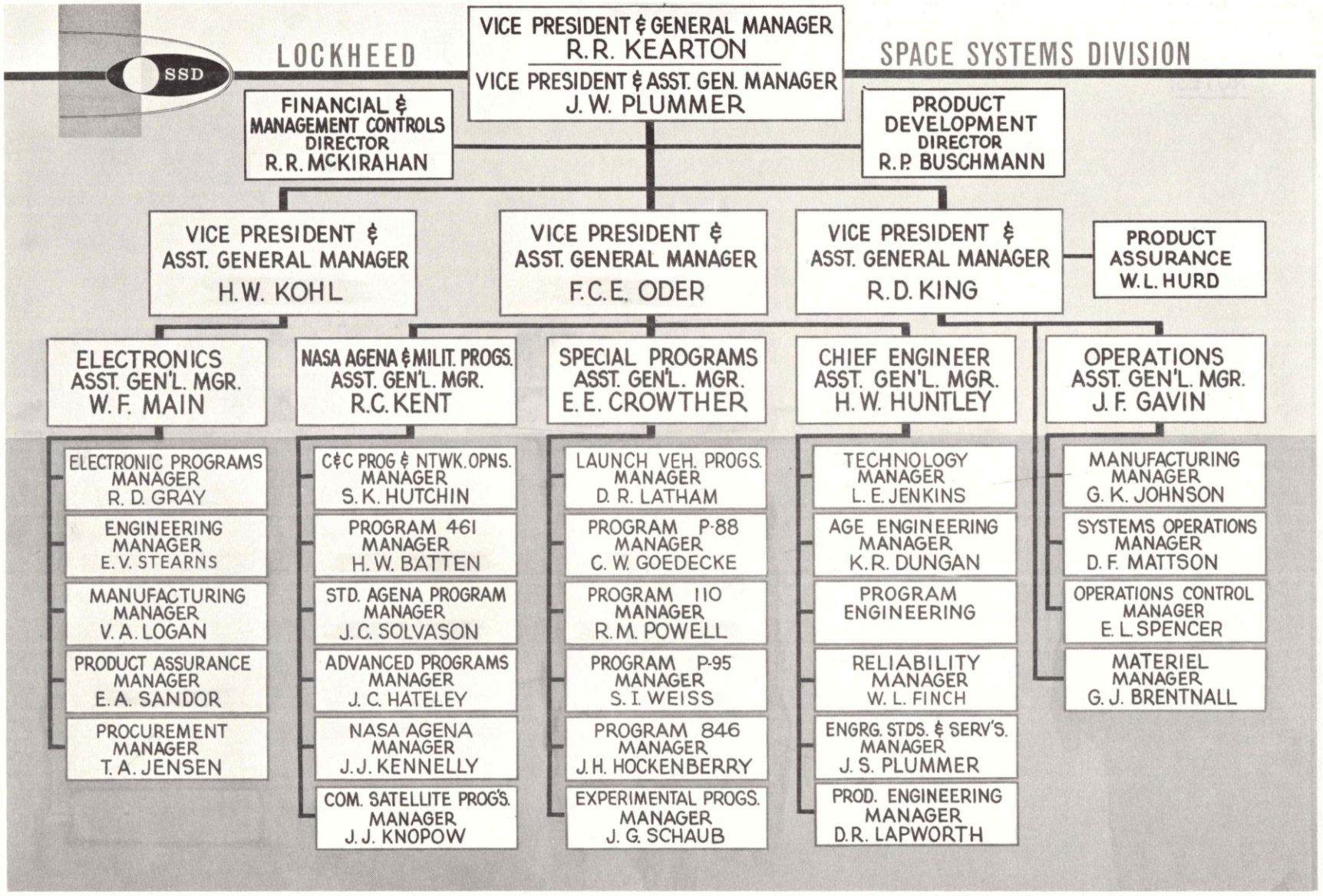
AGENA FIRSTS

- FIRST IN POLAR ORBIT (FEB 1959)
- FIRST TO STABILIZE ON THREE AXES (APR 1959)
- FIRST TO CHANGE ATTITUDE BY COMMAND (APR 1959)
- FIRST SUCCESSFUL RECOVERY (AUG 1960)
- FIRST RESTART ON ORBIT (FEB 1961)
- FIRST U.S. ORBITING VEHICLE TO LAUNCH:
  - MOON PROBE (APR 1962)
  - VENUS FLY-BY (AUG 1962)
  - MARS FLY-BY (NOV 1964)
- FIRST CARRIED SUB-SATELLITE (P-11) AND INJECTED INTO ORBIT (JUN 1963)
- FIRST TO CARRY NUCLEAR REACTOR SYS INTO ORBIT (APR 1965)
- FIRST EMPLOYED IN ORBITAL RENDEZVOUS & DOCKING (MAR 1966)

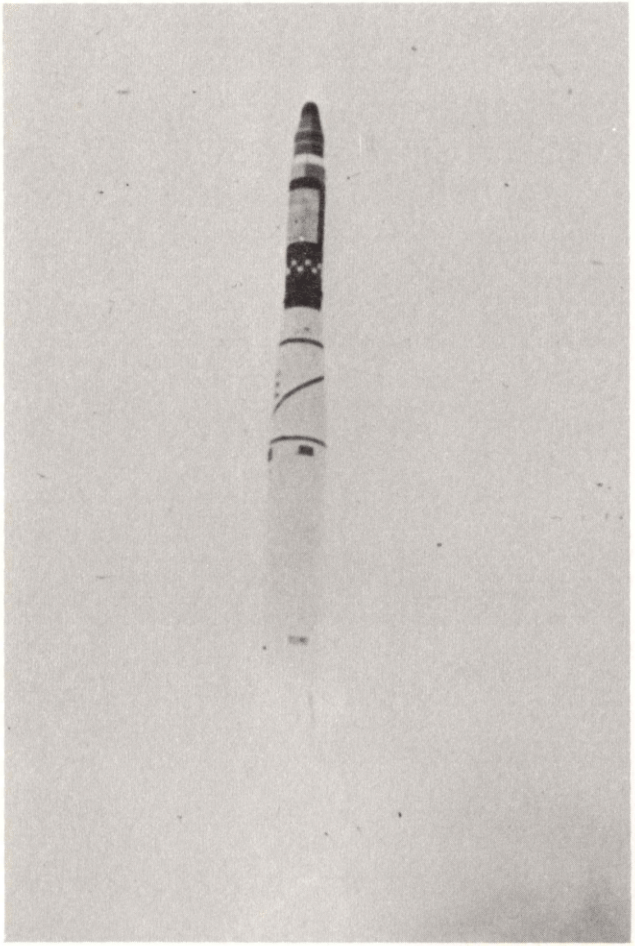

SSD
AGENA APPLICATIONS
EARLY WARNING
COMMUNICATIONS
DEEP SPACE PROBES
AGENA
METEOROLOGY
LUNAR OBSERVATIONS
RESEARCH PAYLOADS
NUCLEAR DETECTION
SPACE RENDEZVOUS



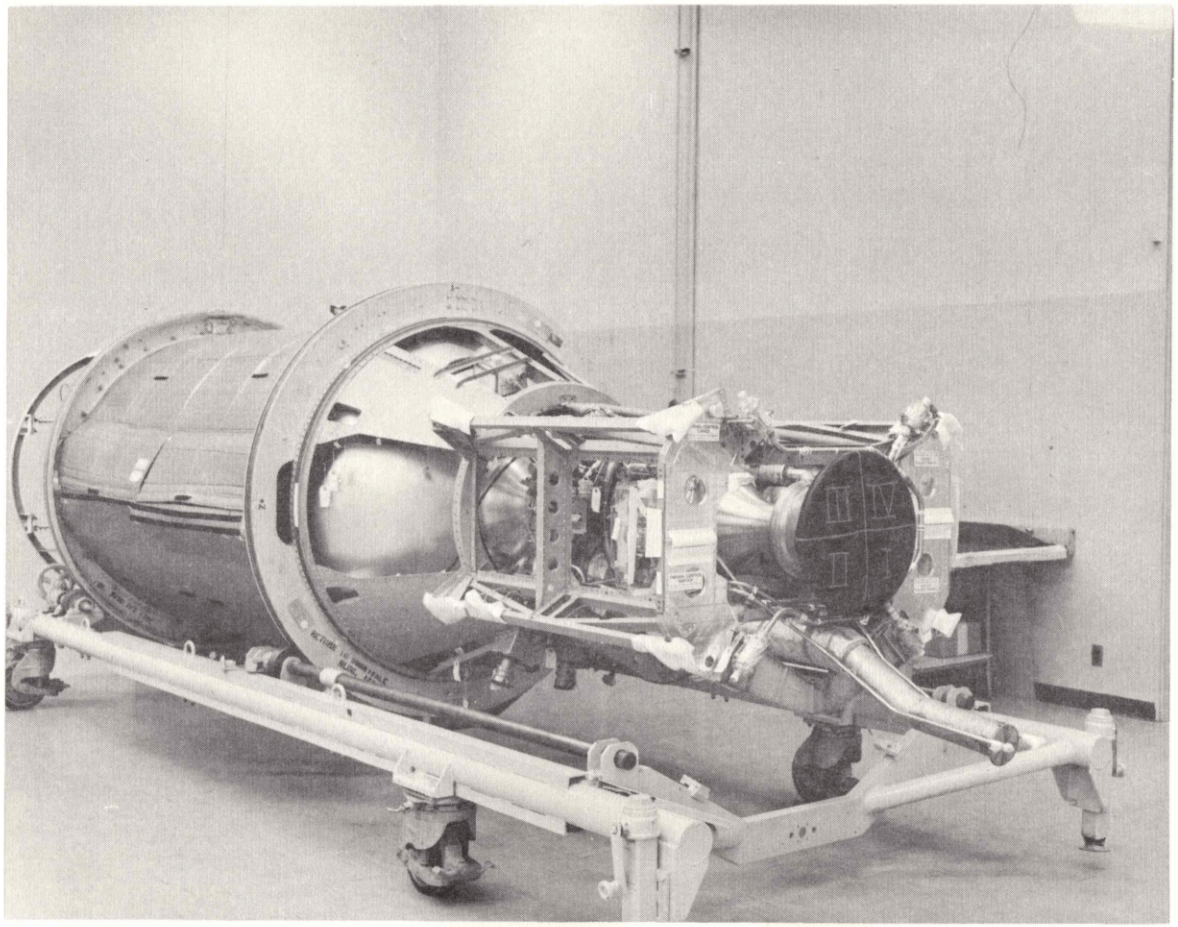
AGENA HISTORY


SSD
LOCKHEED
SPACE SYSTEMS DIVISION
VICE PRESIDENT & GENERAL MANAGER
R.R. KEARTON
VICE PRESIDENT & ASST. GEN. MANAGER
J. W. PLUMMER
FINANCIAL & MANAGEMENT CONTROLS DIRECTOR
R.R. McKIRAHAN
PRODUCT DEVELOPMENT DIRECTOR
R.P. BUSCHMANN
VICE PRESIDENT & ASST. GENERAL MANAGER
H.W. KOHL
VICE PRESIDENT & ASST. GENERAL MANAGER
F.C.E. ODER
VICE PRESIDENT & ASST. GENERAL MANAGER
R.D. KING
PRODUCT ASSURANCE
W.L. HURD
ELECTRONICS ASST. GEN'L. MGR.
W.F. MAIN
NASA AGENA & MILIT. PROGS. ASST. GEN'L. MGR.
R.C. KENT
SPECIAL PROGRAMS ASST. GEN'L. MGR.
E.E. CROWTHER
CHIEF ENGINEER ASST. GEN'L. MGR.
H.W. HUNTLEY
OPERATIONS ASST. GEN'L. MGR.
J.F. GAVIN
ELECTRONIC PROGRAMS MANAGER
R.D. GRAY
ENGINEERING MANAGER
E.V. STEARNS
MANUFACTURING MANAGER
V.A. LOGAN
PRODUCT ASSURANCE MANAGER
E.A. SANDOR
PROCUREMENT MANAGER
T.A. JENSEN
C&C PROG & NTWK. OPNS. MANAGER
S.K. HUTCHIN
PROGRAM 461 MANAGER
H.W. BATTEN
STD. AGENA PROGRAM MANAGER
J.C. SOLVASON
ADVANCED PROGRAMS MANAGER
J.C. HATELEY
NASA AGENA MANAGER
J.J. KENNELLY
COM. SATELLITE PROG'S. MANAGER
J.J. KNOPOW
LAUNCH VEH. PROGS. MANAGER
D.R. LATHAM
PROGRAM P-88 MANAGER
C.W. GOEDECKE
PROGRAM 110 MANAGER
R.M. POWELL
PROGRAM P-95 MANAGER
S.I. WEISS
PROGRAM 846 MANAGER
J.H. HOCKENBERRY
EXPERIMENTAL PROGS. MANAGER
J.G. SCHAUB
TECHNOLOGY MANAGER
L.E. JENKINS
AGE ENGINEERING MANAGER
K.R. DUNGAN
PROGRAM ENGINEERING
RELIABILITY MANAGER
W.L. FINCH
ENGRG. STDS. & SERV'S. MANAGER
J.S. PLUMMER
PROD. ENGINEERING MANAGER
D.R. LAPWORTH
MANUFACTURING MANAGER
G.K. JOHNSON
SYSTEMS OPERATIONS MANAGER
D.F. MATTSON
OPERATIONS CONTROL MANAGER
E.L. SPENCER
MATERIEL MANAGER
G.J. BRENTNALL

FIRST THOR/AGENA LAUNCH

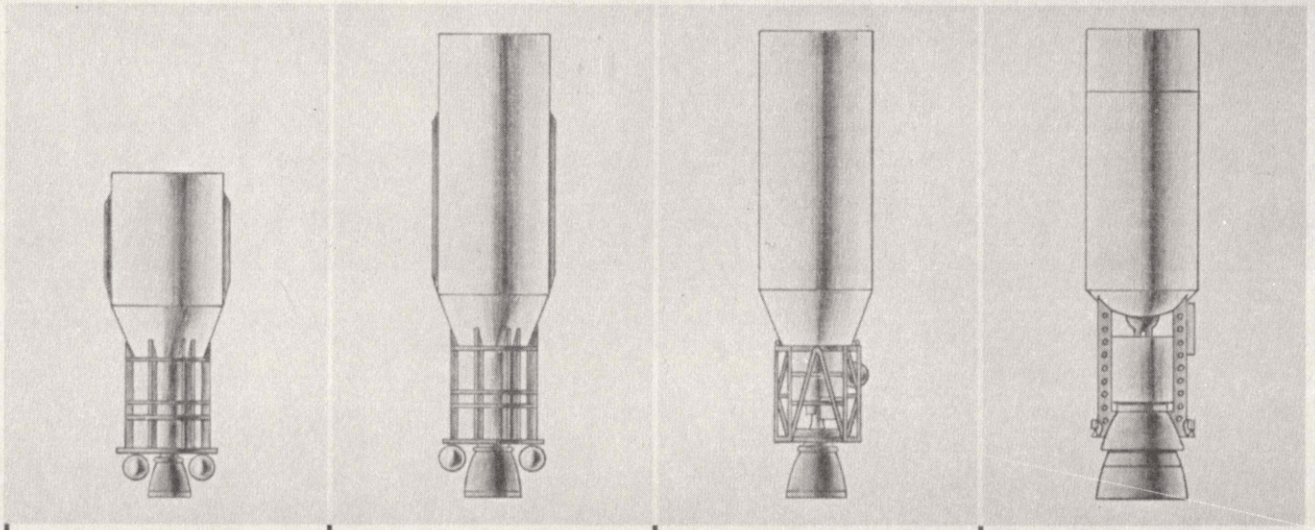


STANDARD AGENA



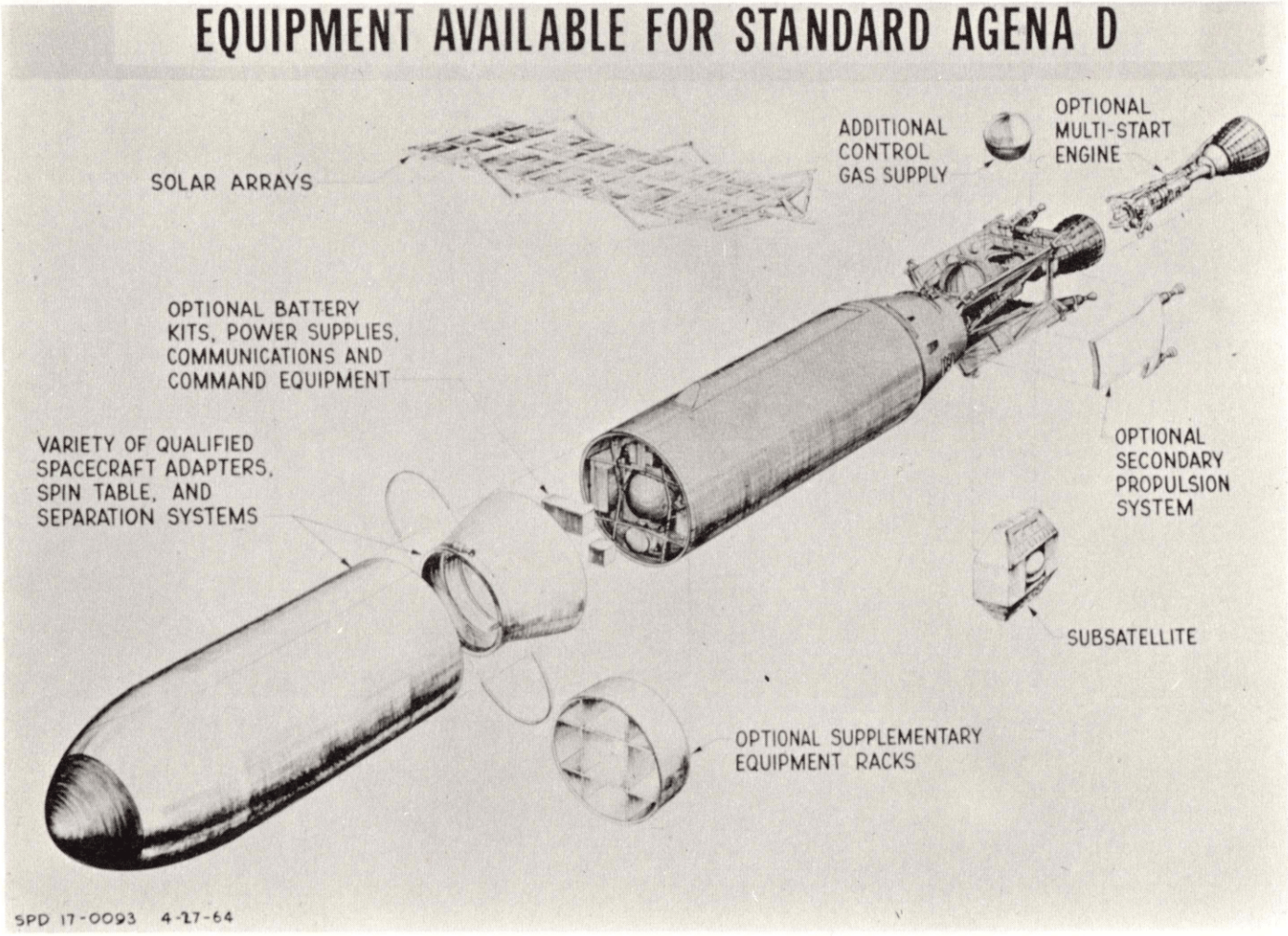
AGENA DEVELOPMENT

AS OF 10-16-67

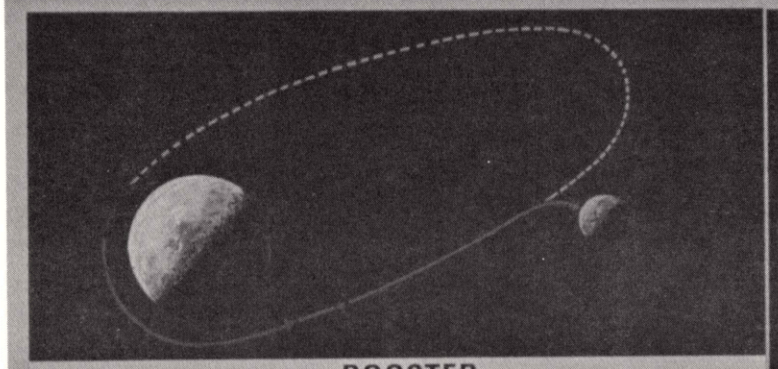


	A	B	D	S6D
LAUNCHES	19	74	157	—
TIME PERIOD	SEP 56 JAN 61	JUL 59 JUN 66	AUG 61 CONTINUING	FEB 67 CONTINUING

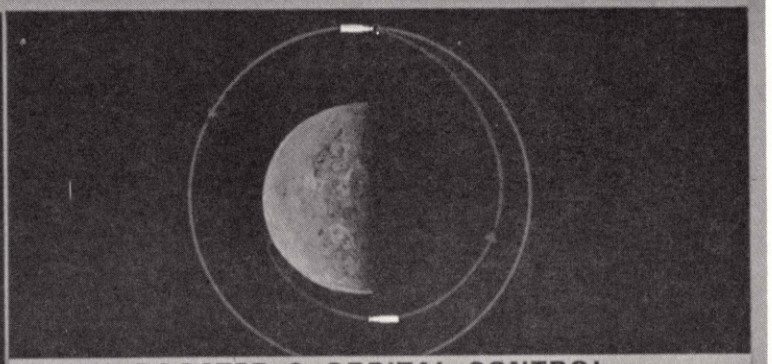
EQUIPMENT AVAILABLE FOR STANDARD AGENA D



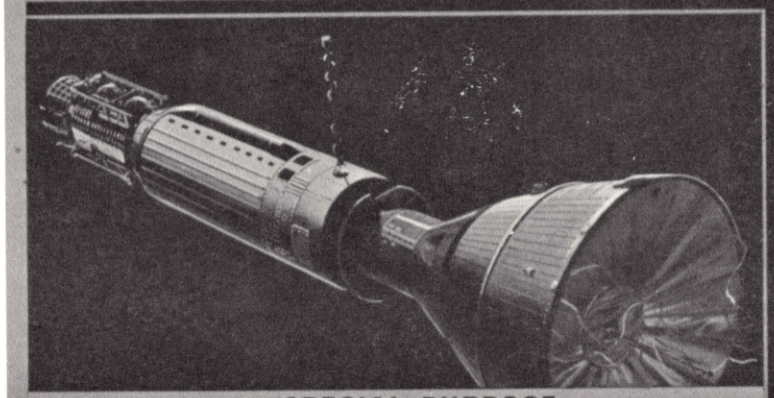
Uses of Agena



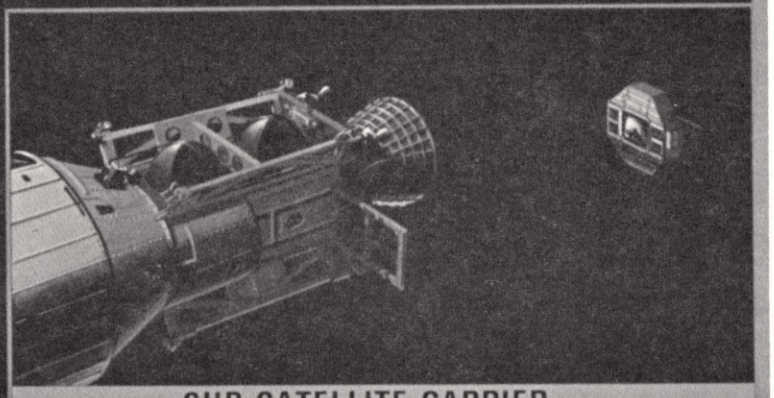
BOOSTER



BOOSTER & ORBITAL CONTROL



SPECIAL PURPOSE



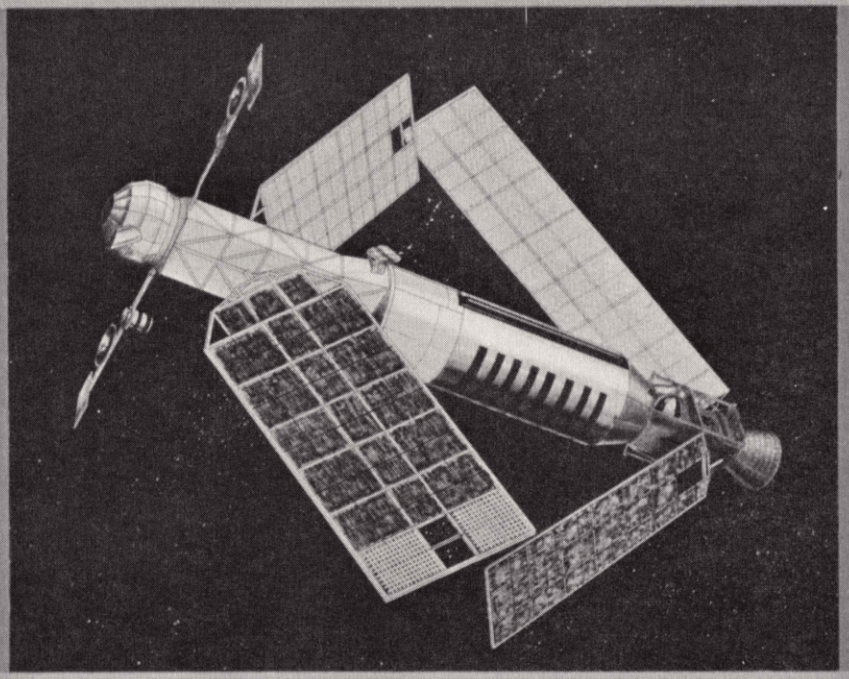
SUB-SATELLITE CARRIER

SSD

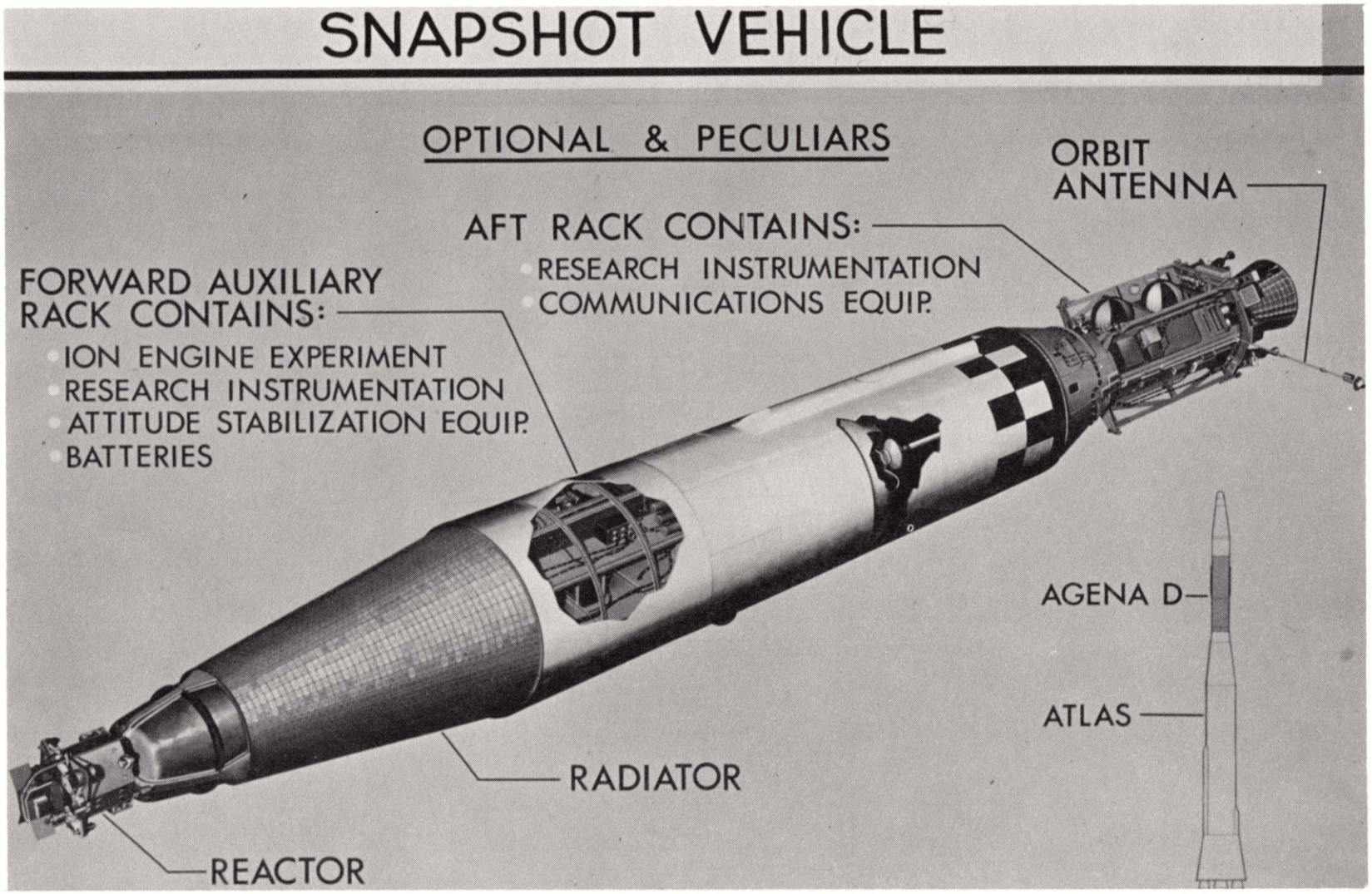
PROGRAM 461

DATES LAUNCHED:

- 19 AUGUST 1966
- 5 OCTOBER 1966

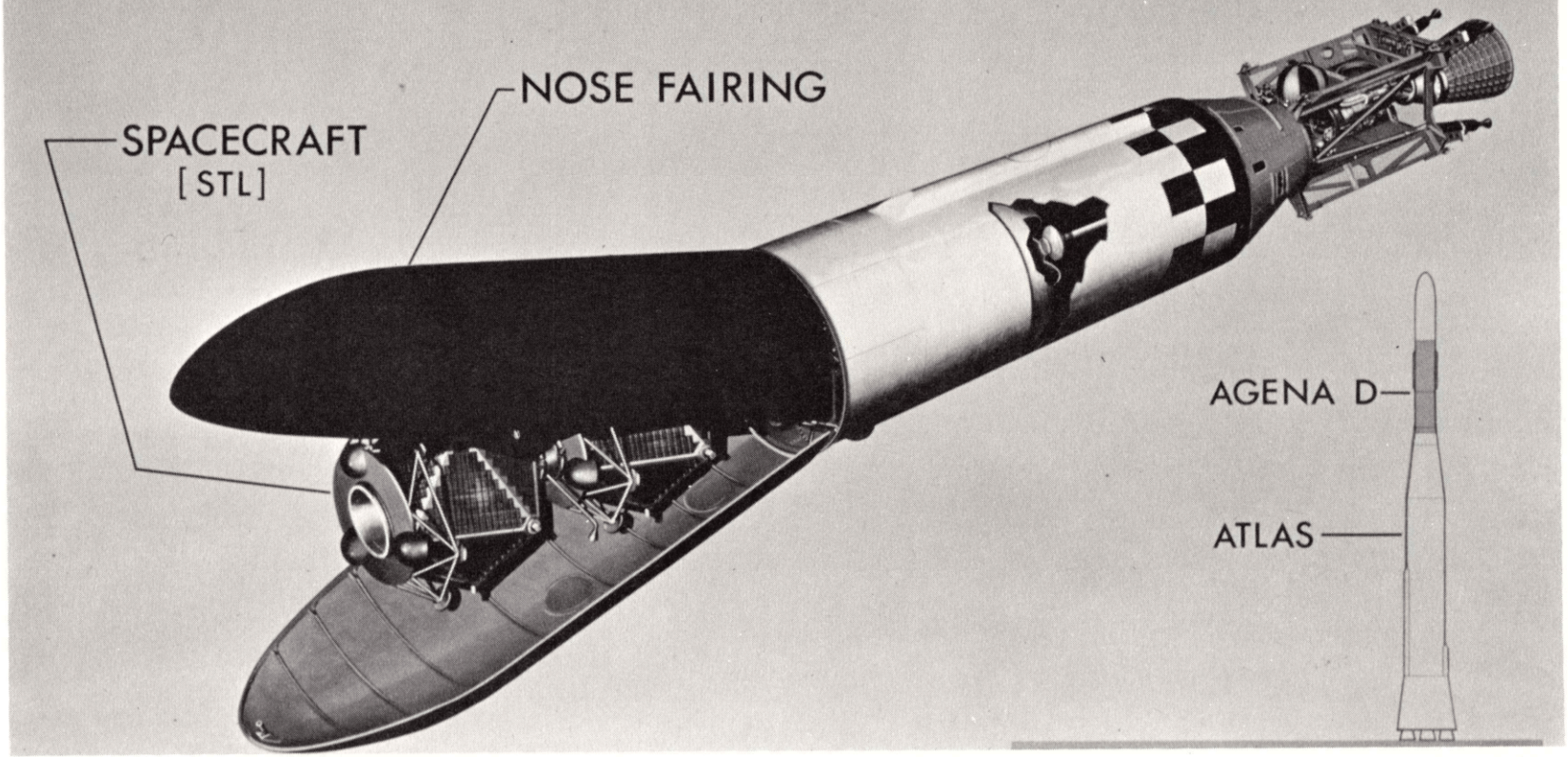


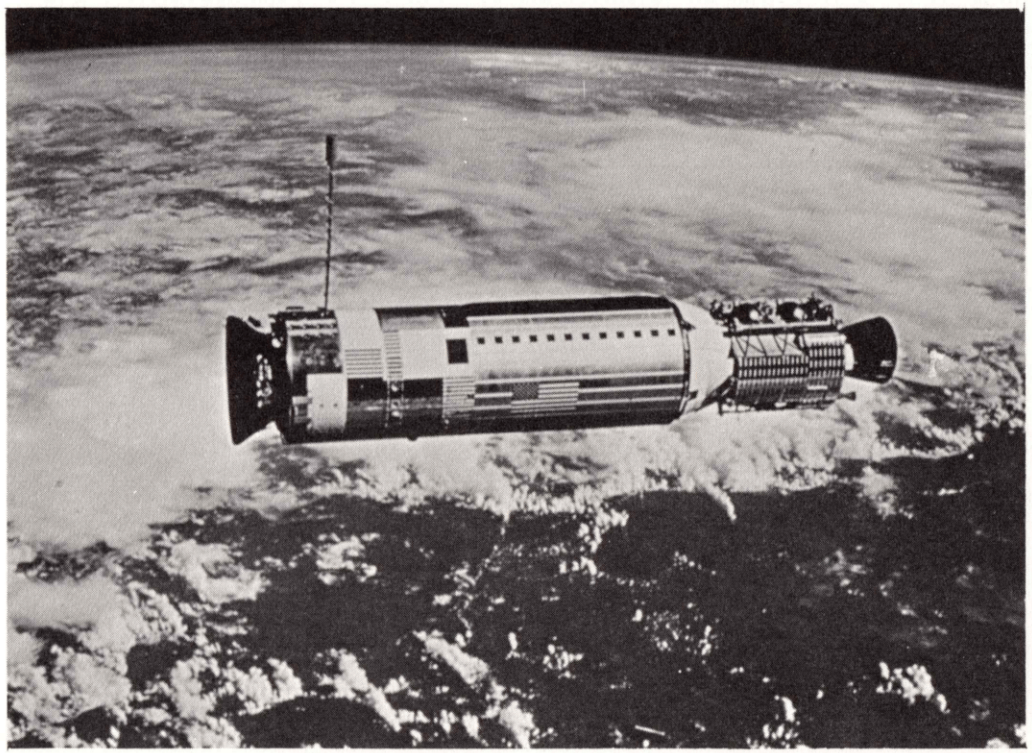
SSD


SNAPSHOT VEHICLE
OPTIONAL & PECULIARS
ORBIT ANTENNA
AFT RACK CONTAINS:
RESEARCH INSTRUMENTATION
COMMUNICATIONS EQUIP.
FORWARD AUXILIARY RACK CONTAINS:
ION ENGINE EXPERIMENT
RESEARCH INSTRUMENTATION
ATTITUDE STABILIZATION EQUIP.
BATTERIES
AGENA D
ATLAS
RADIATOR
REACTOR

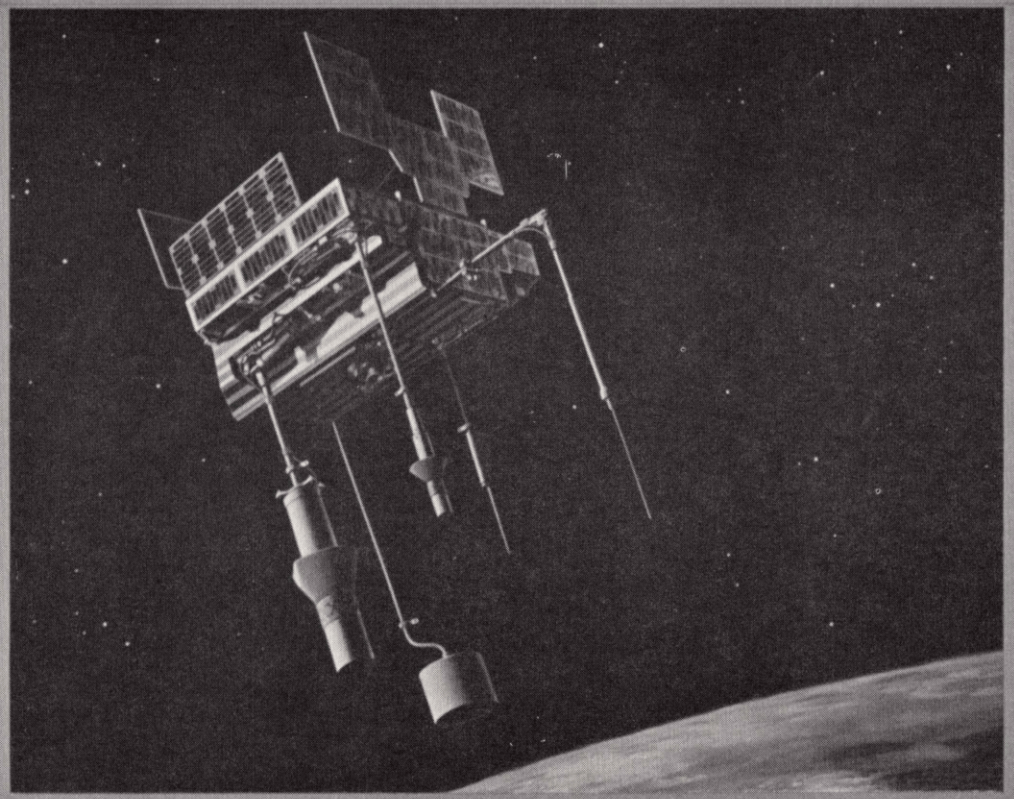
VELA SATELLITE VEHICLE (U)

OPTIONALS & PECULIARS

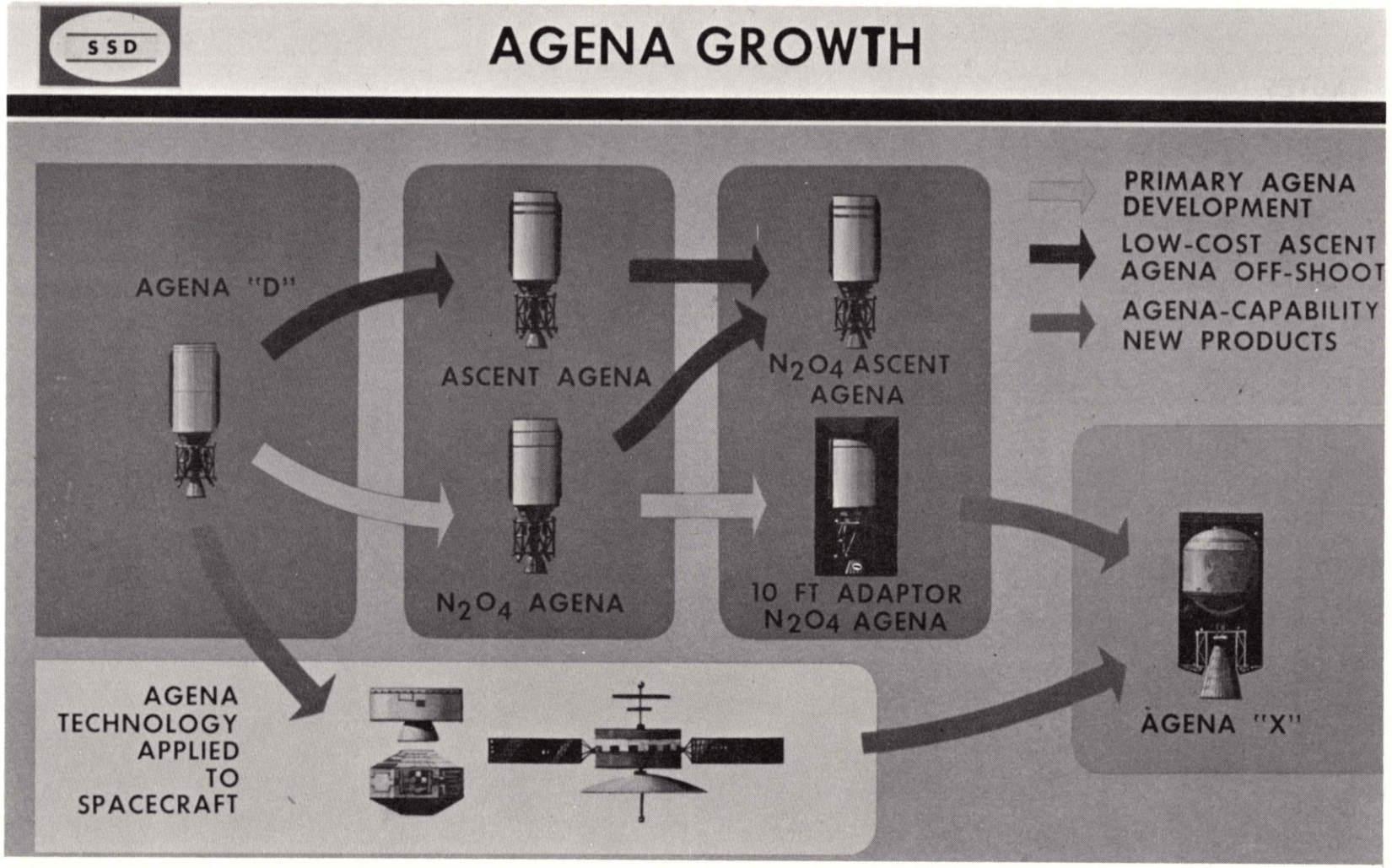


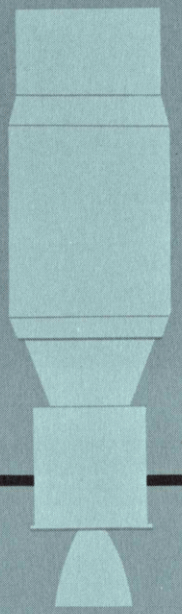


P-II Calibration Satellite



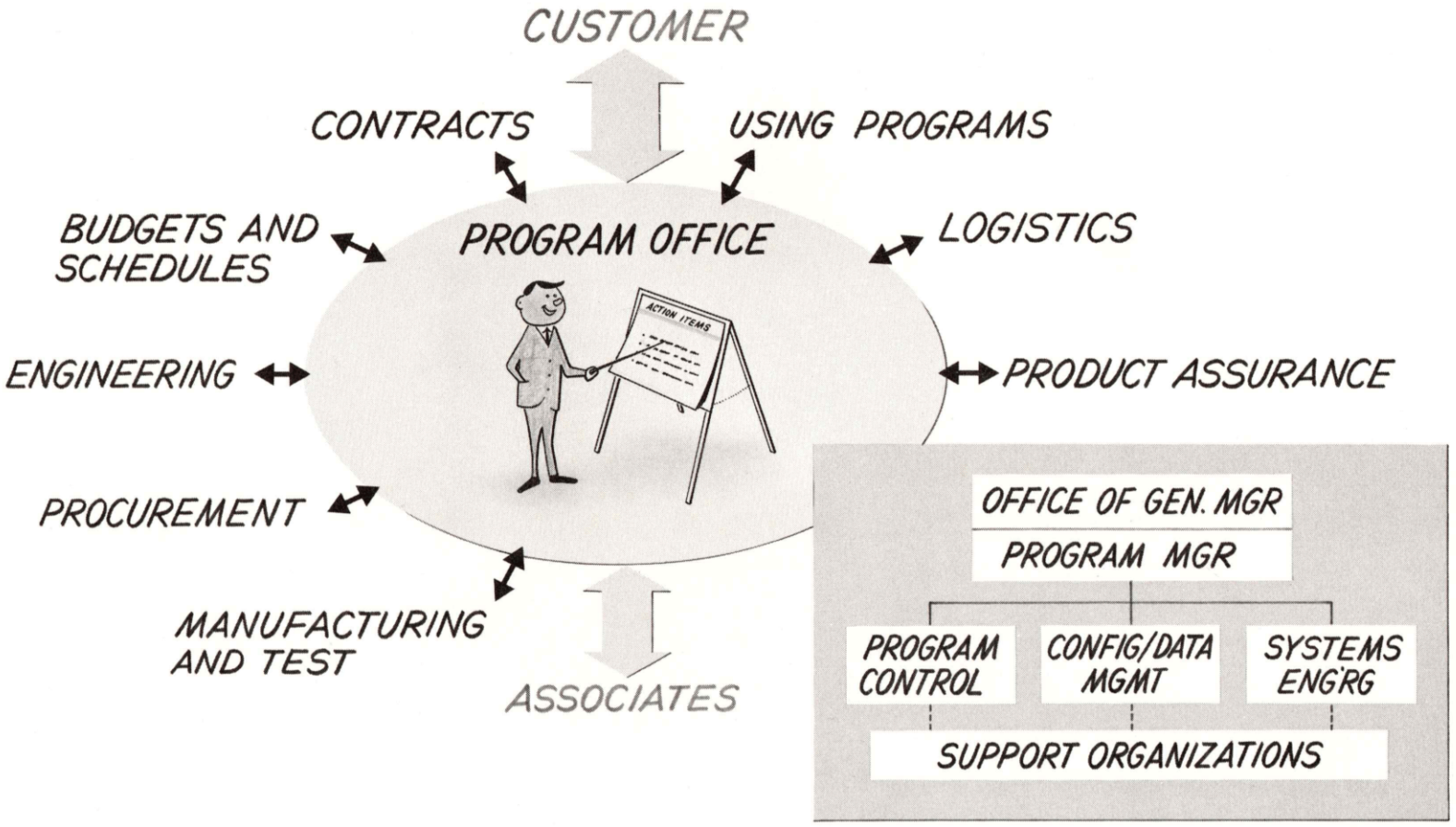
SSD


SSD
AGENA GROWTH
AGENA "D"
ASCENT AGENA
N_2O_4 ASCENT AGENA
N_2O_4 AGENA
10 FT ADAPTOR N_2O_4 AGENA
PRIMARY AGENA DEVELOPMENT
LOW-COST ASCENT AGENA OFF-SHOOT
AGENA-CAPABILITY NEW PRODUCTS
AGENA TECHNOLOGY APPLIED TO SPACECRAFT
AGENA "X"

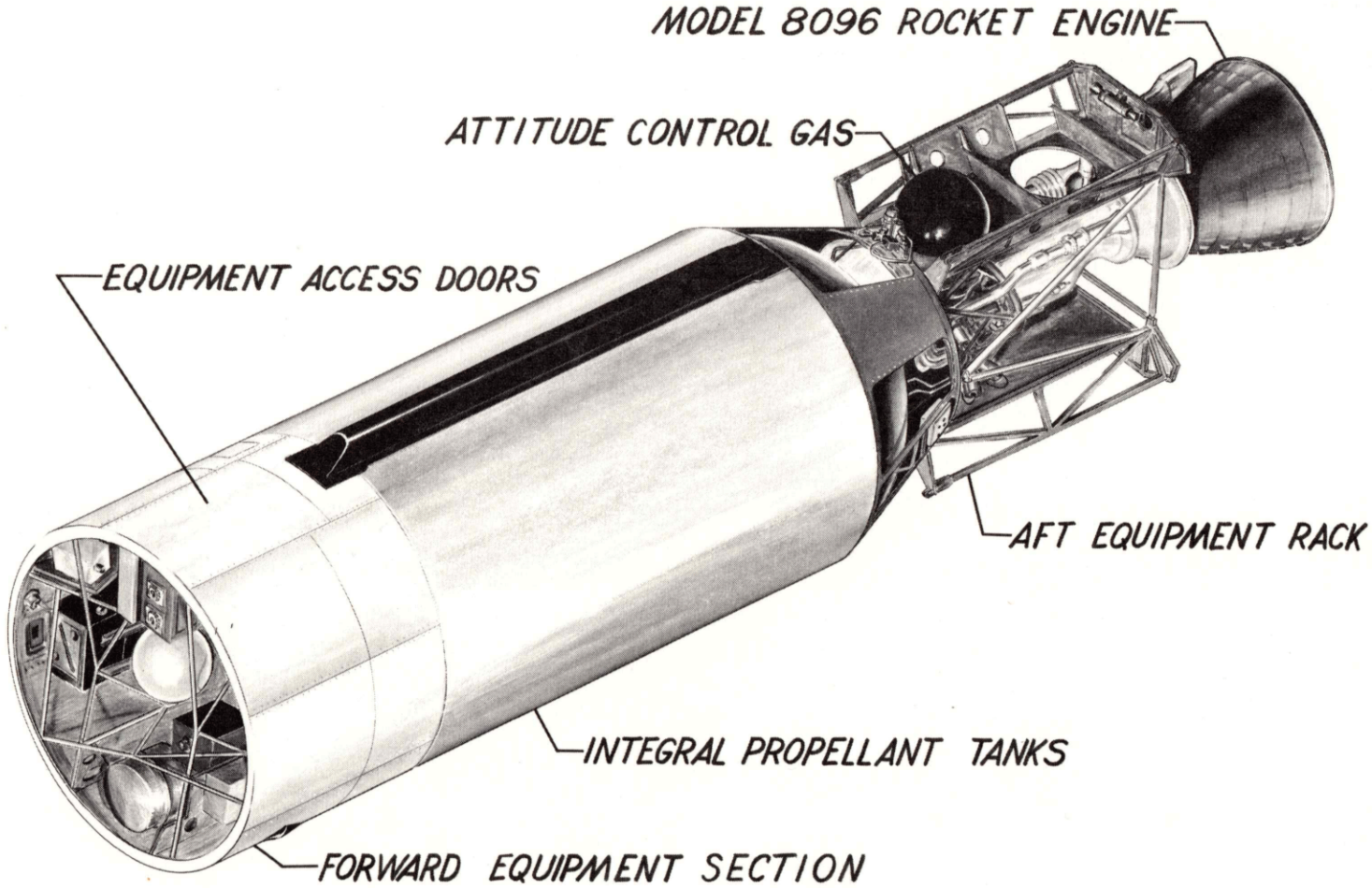


AGENA VEHICLE SUMMARY

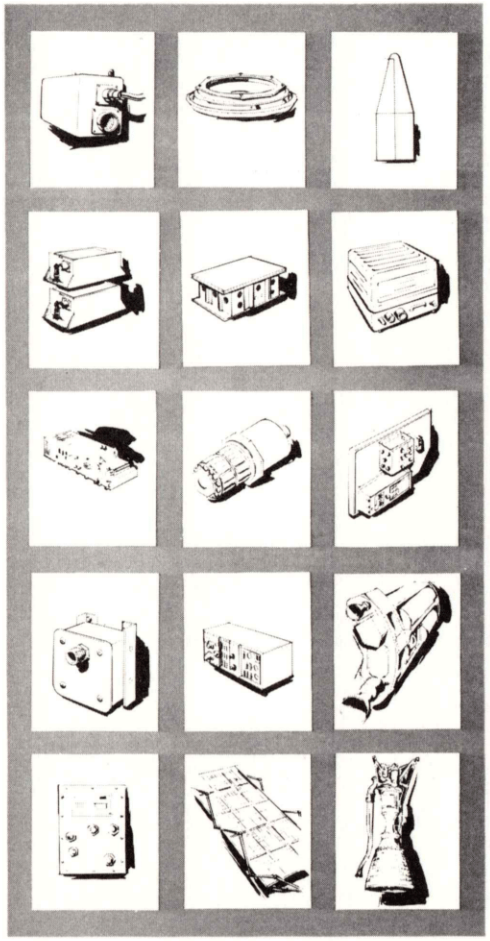
AGENA PROGRAM OFFICE

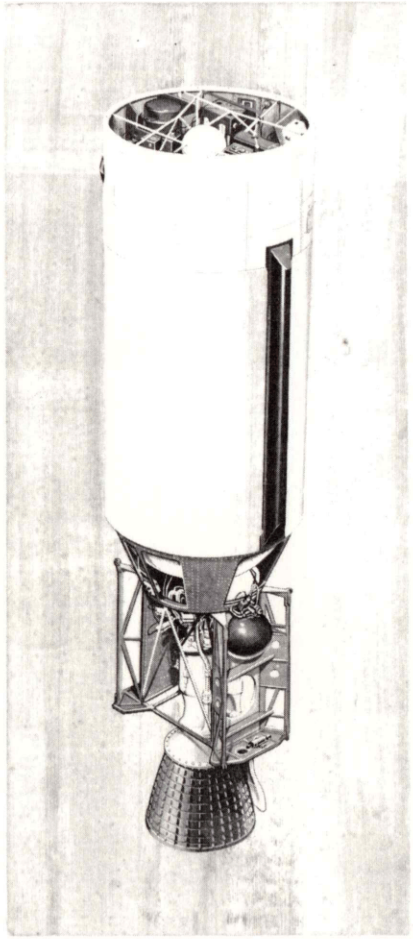


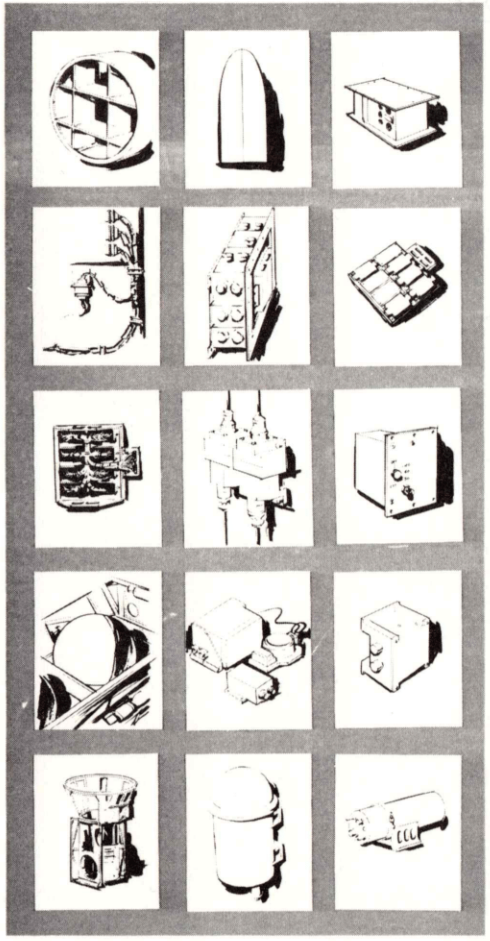
THE MULTIPURPOSE AGENA SPACECRAFT



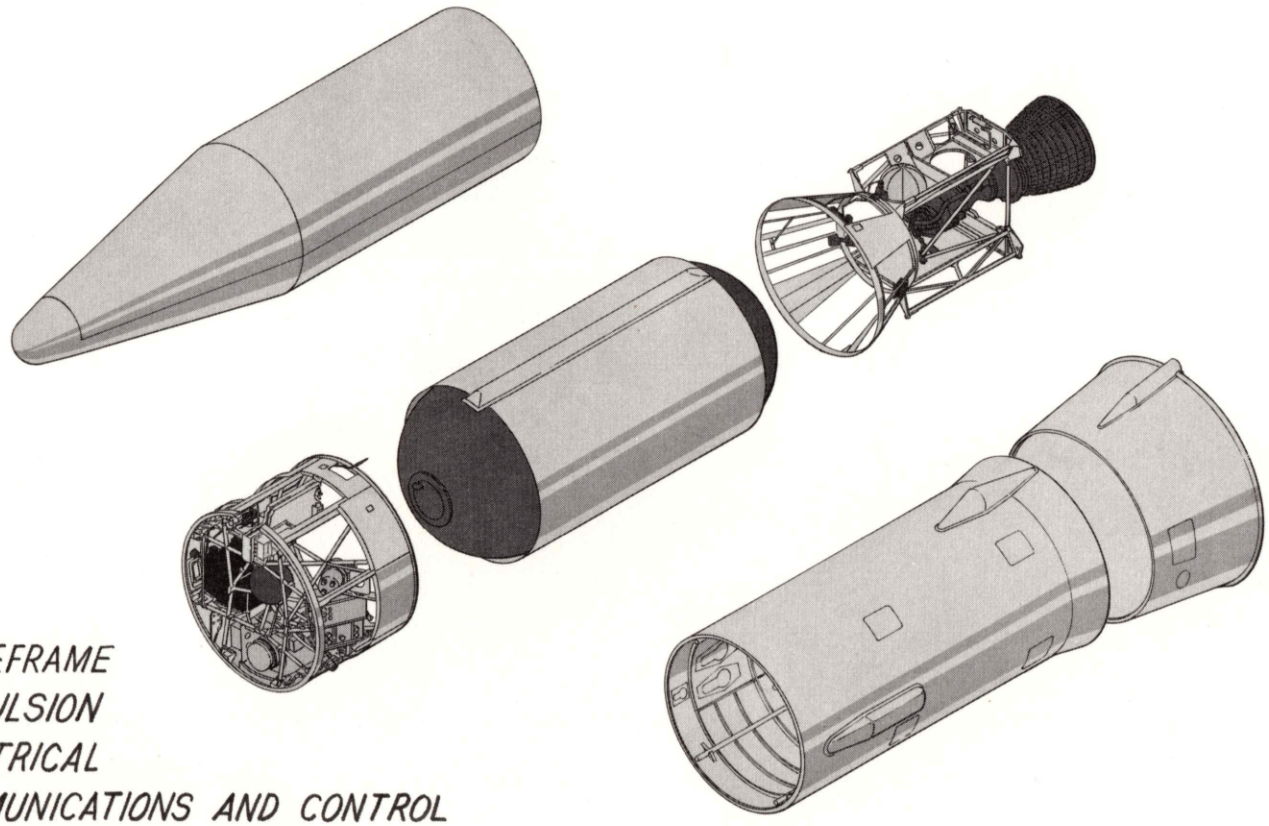
STANDARDIZED SPACECRAFT MISSION COMPONENTS





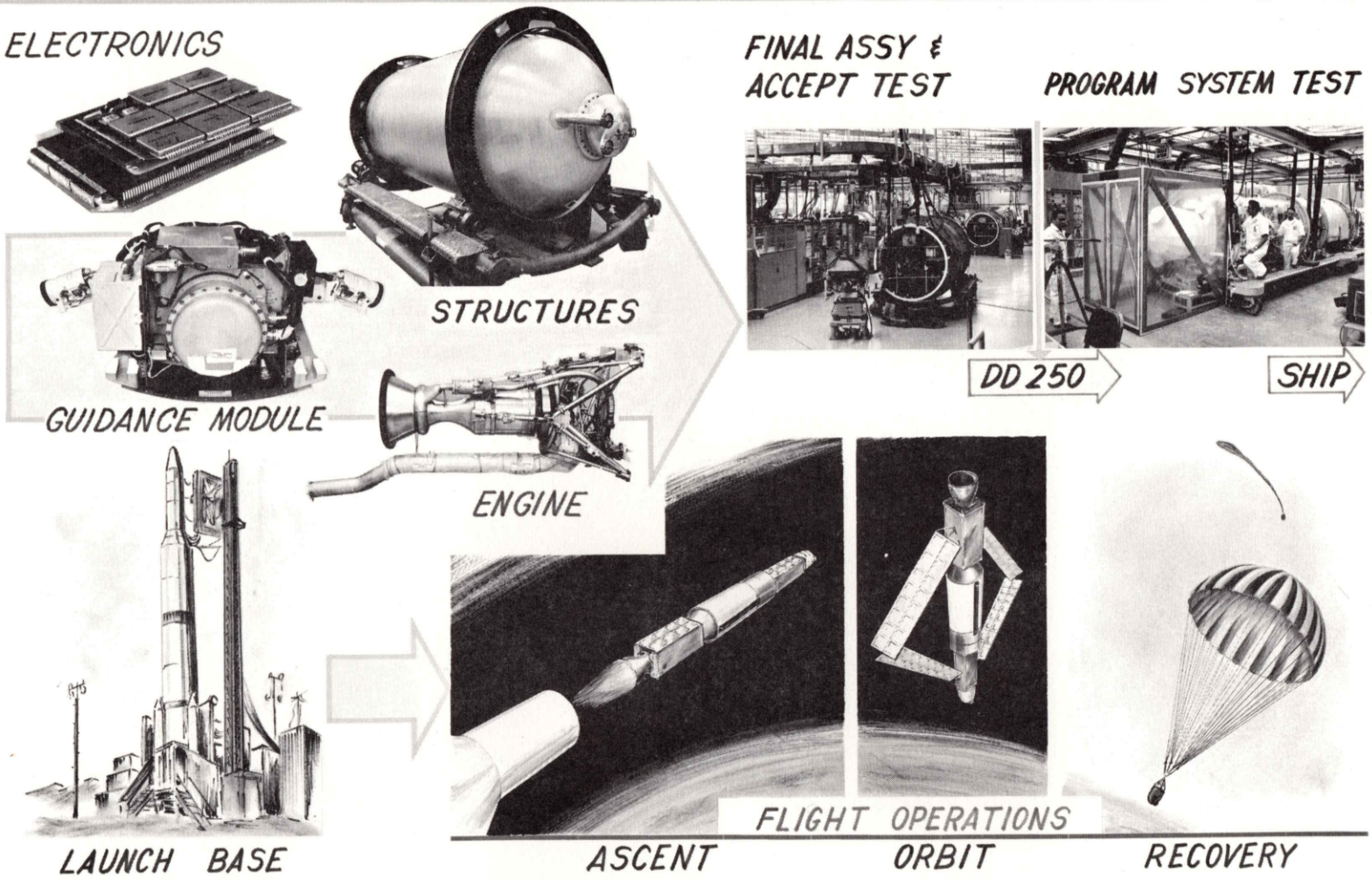


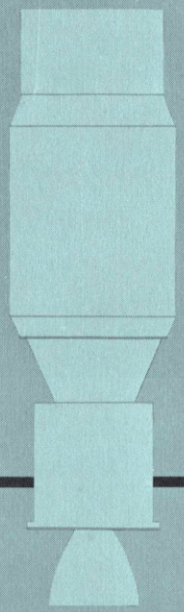
AGENA SUBSYSTEMS



- SPACEFRAME
- PROPULSION
- ELECTRICAL
- COMMUNICATIONS AND CONTROL
- GUIDANCE AND CONTROL

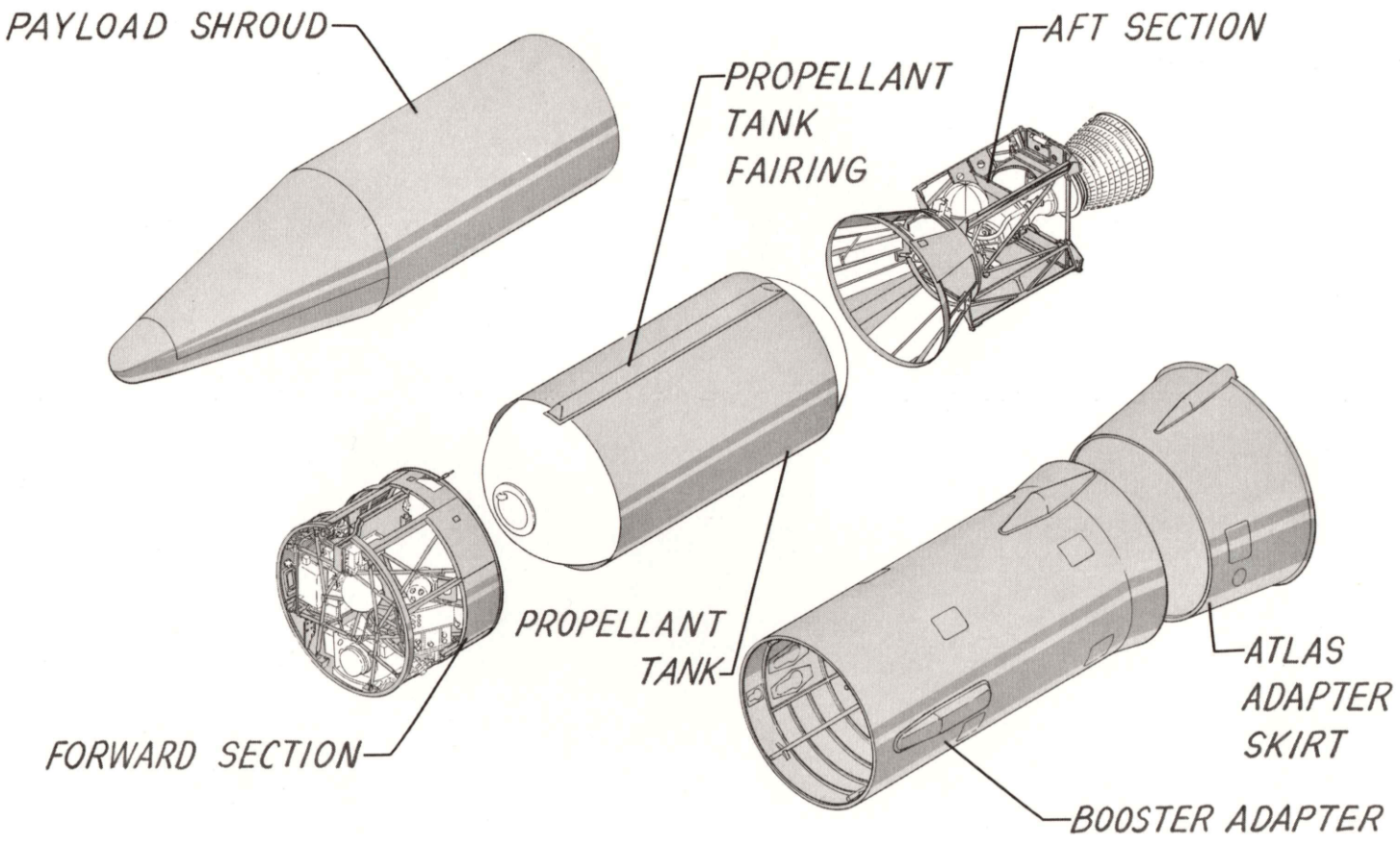
AGENA LIFE CYCLE





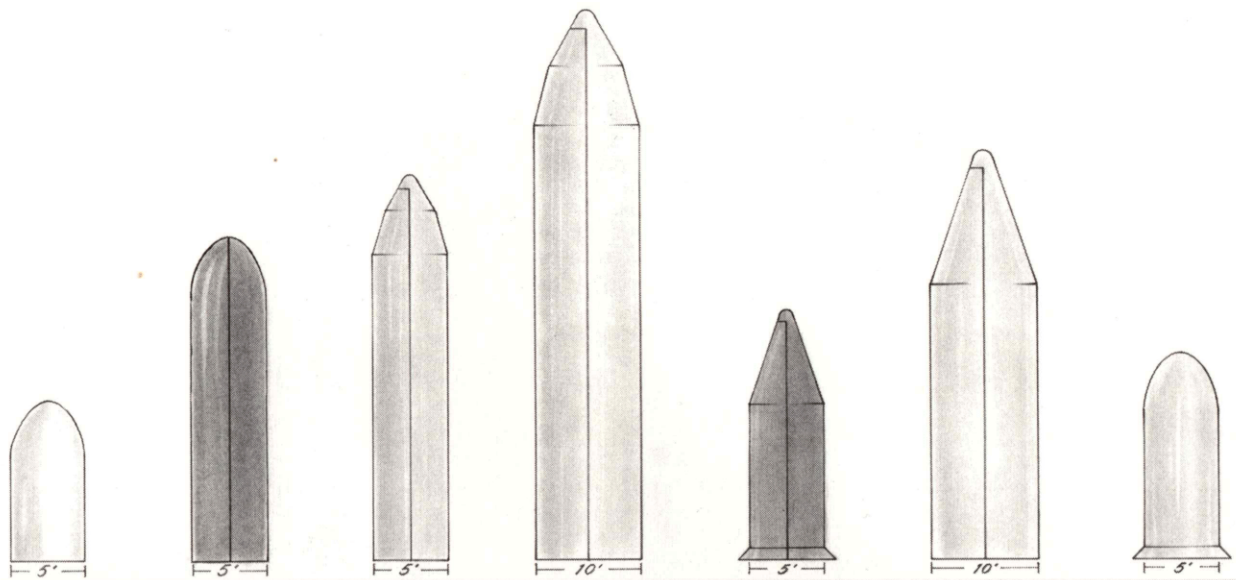
AGENA SPACEFRAME/SHROUDS

SPACEFRAME


PAYLOAD SHROUD
PROPELLANT TANK FAIRING
AFT SECTION
PROPELLANT TANK
FORWARD SECTION
ATLAS ADAPTER SKIRT
BOOSTER ADAPTER

SHROUD FAMILY

1. LENGTH - AS REQUIRED
2. PAYLOAD ACCESS - AS REQUIRED
3. AIR CONDITIONING & VENTING - AS REQUIRED
4. SEPARATION SYS. - MDF, ZIPCORD OR V-BAND



OVER-THE-NOSE MARINER TYPE-METAL

CLAMSHELL VELA TYPE FIBERGLASS

CLAMSHELL 169 TYPE METAL

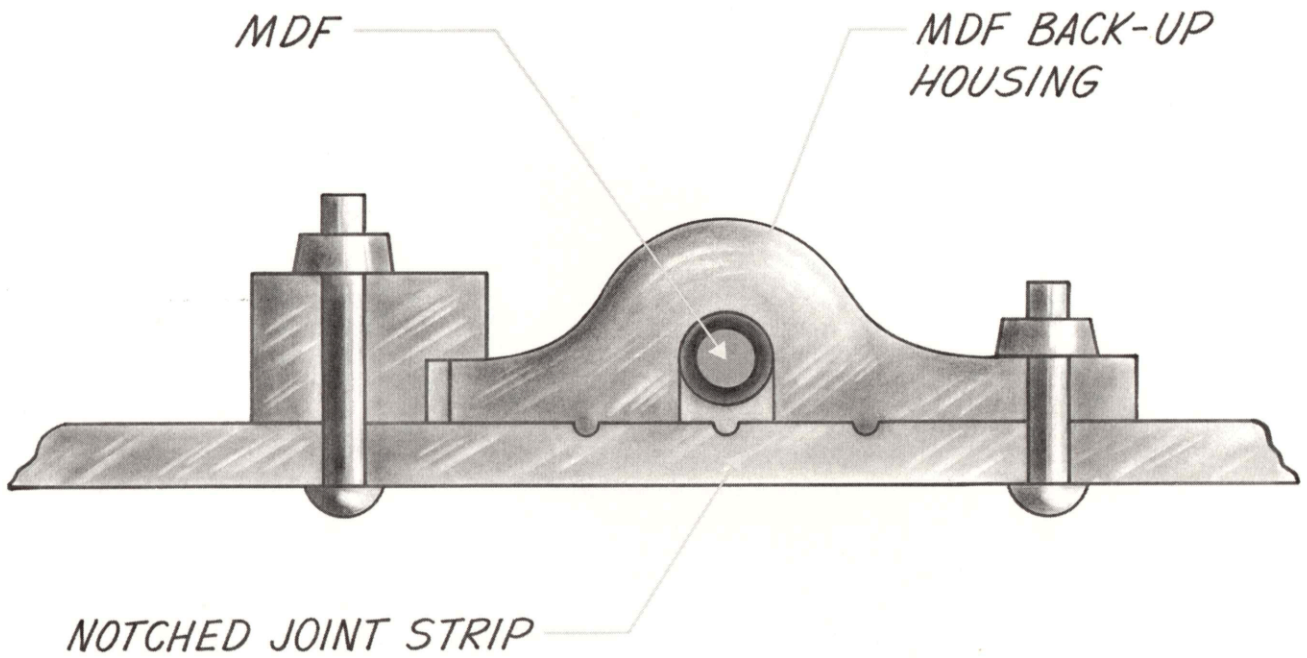
CLAMSHELL METAL

SACS CLAMSHELL FIBERGLASS

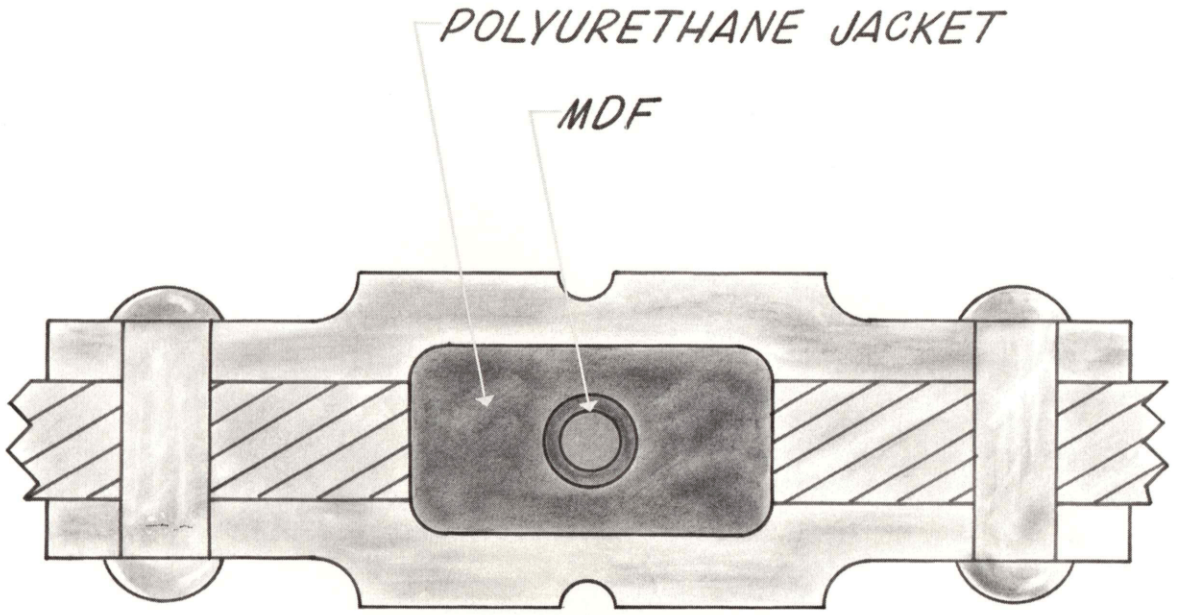
OAO CLAMSHELL METAL

LUNAR ORBITER OVER-THE-NOSE METAL

MDF SEPARATION JOINT



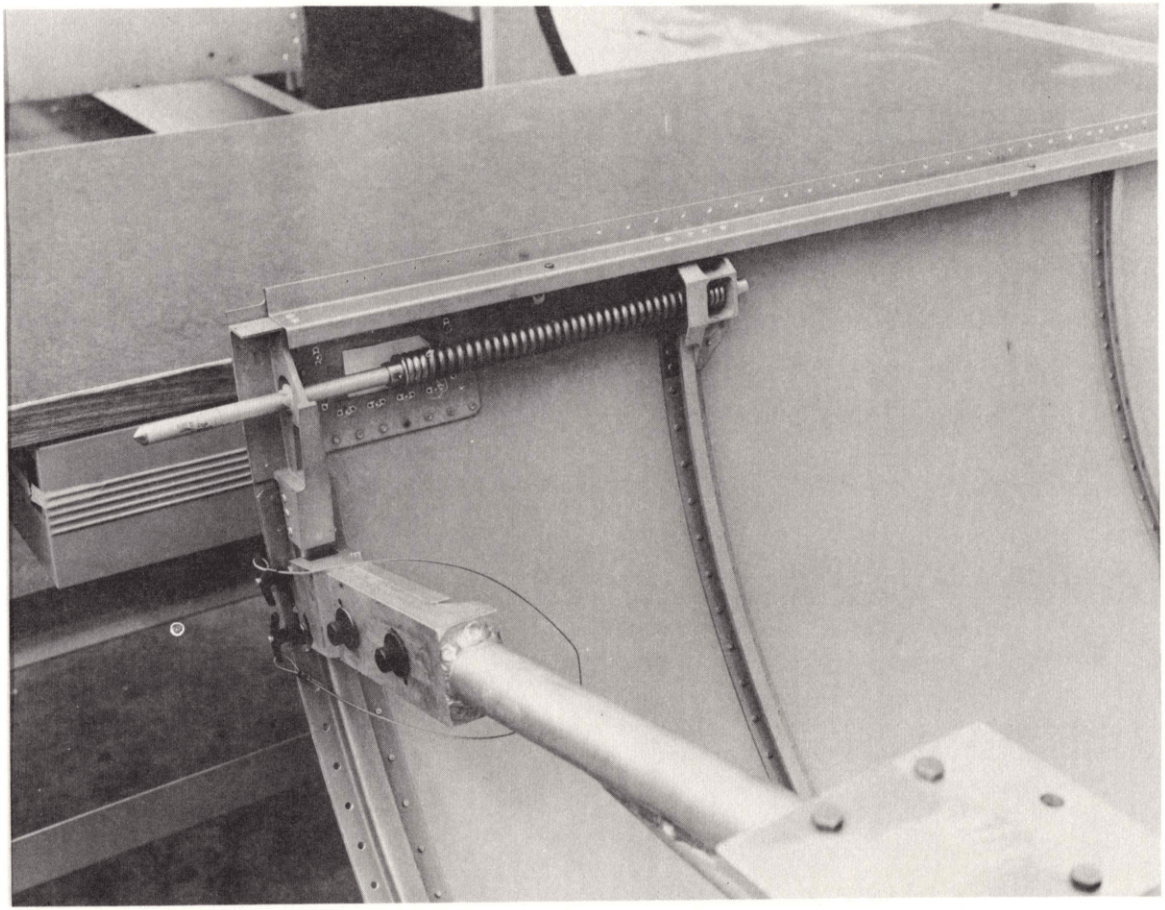
ZIPCORD SEPARATION JOINT



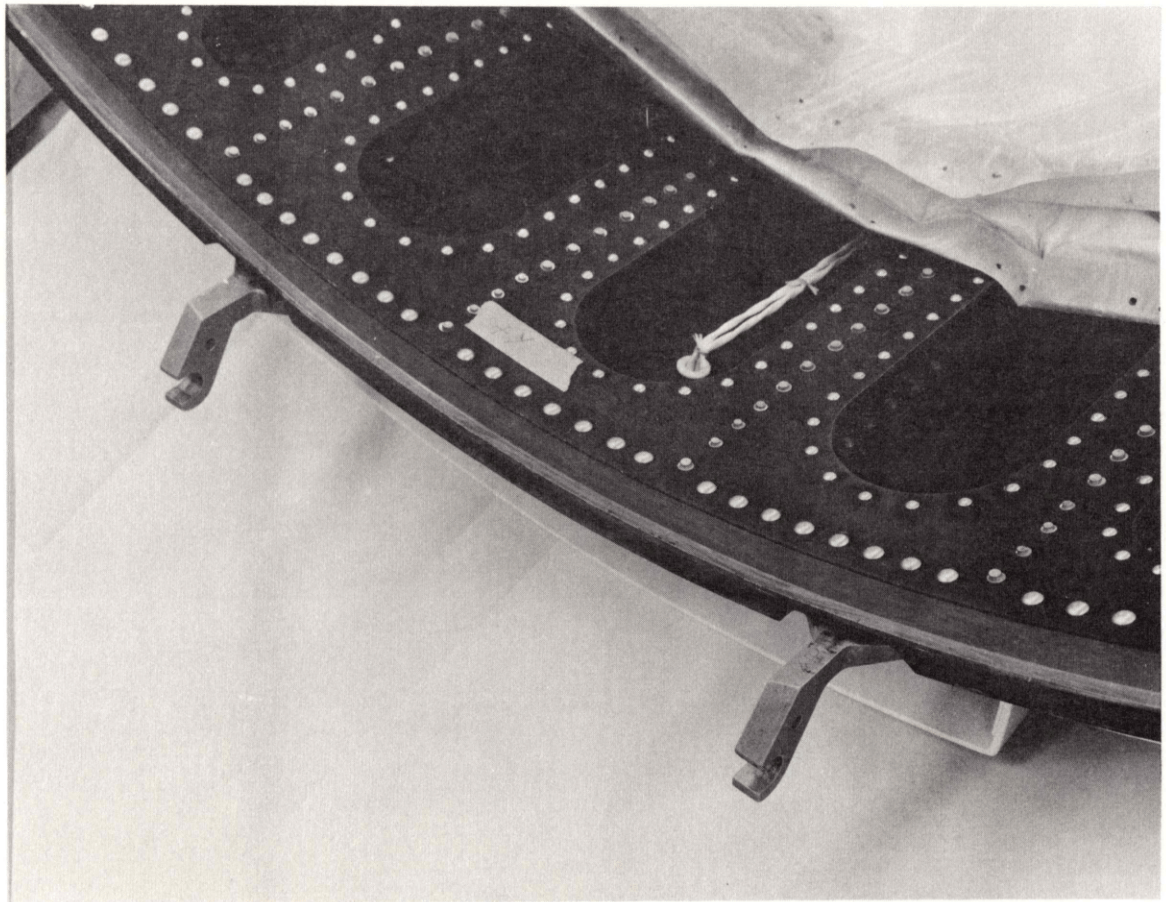
ADVANTAGES

1. LOW SHOCK SEPARATION
2. CLEAN SEPARATION
3. HANDLING & INSTALLATION

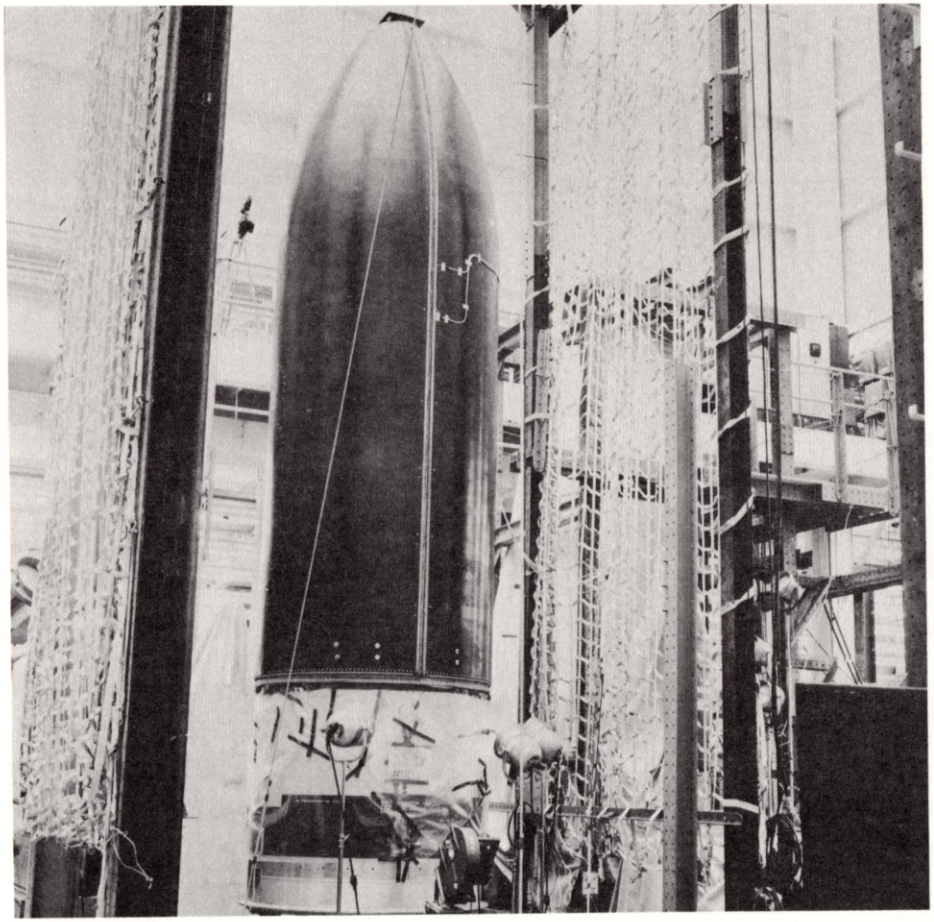
SPRING SYSTEM



HINGE SYSTEM



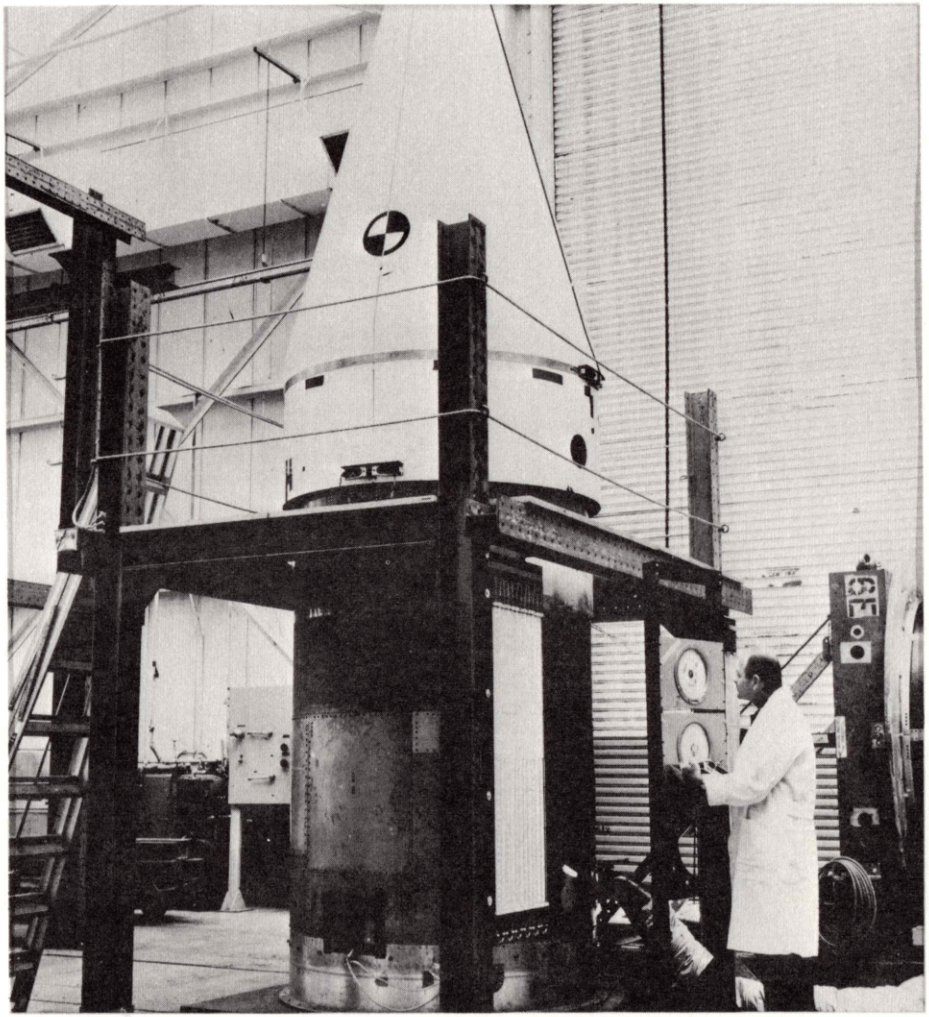
VELA SHROUD



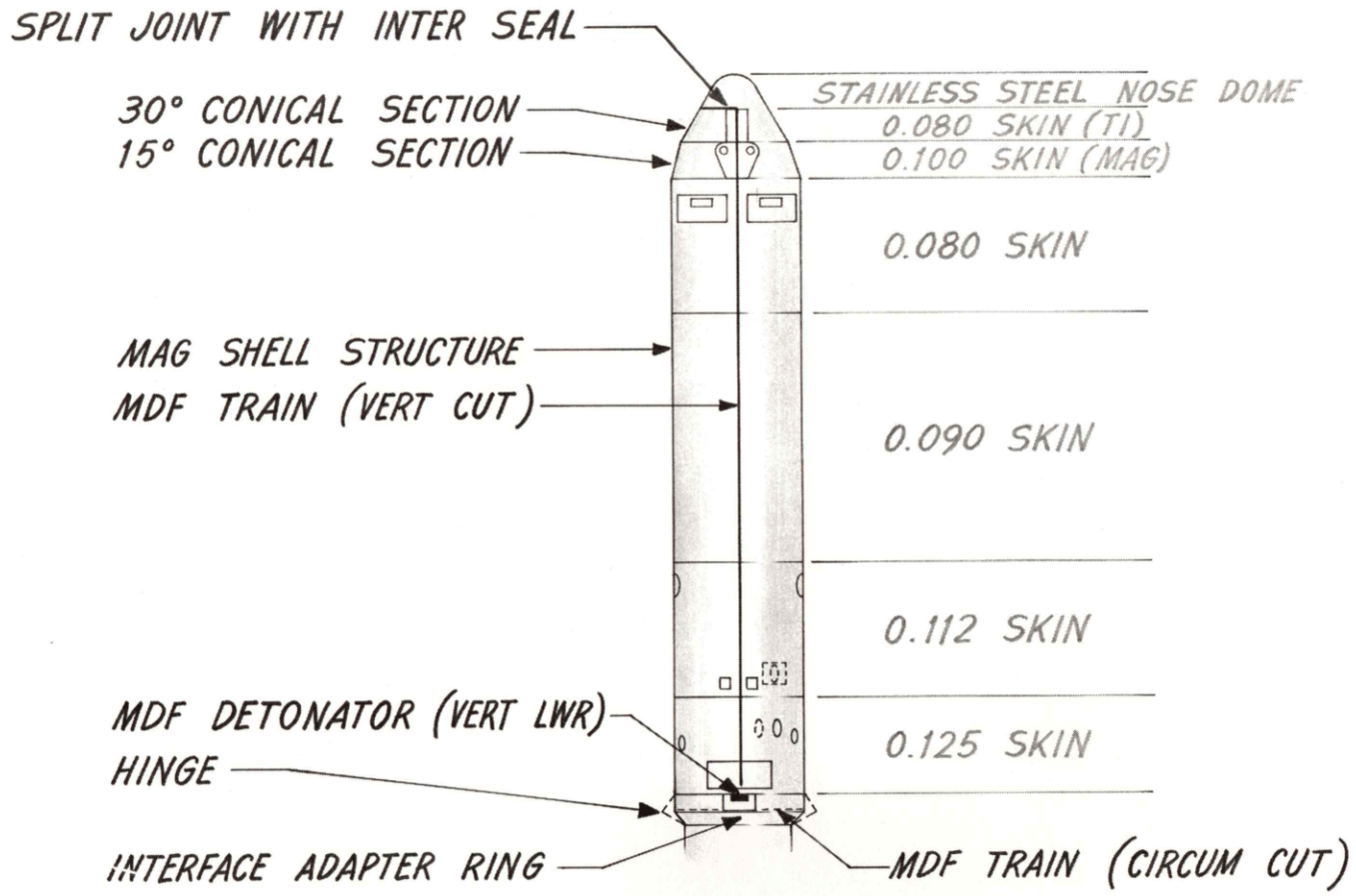
MARINER SHROUD



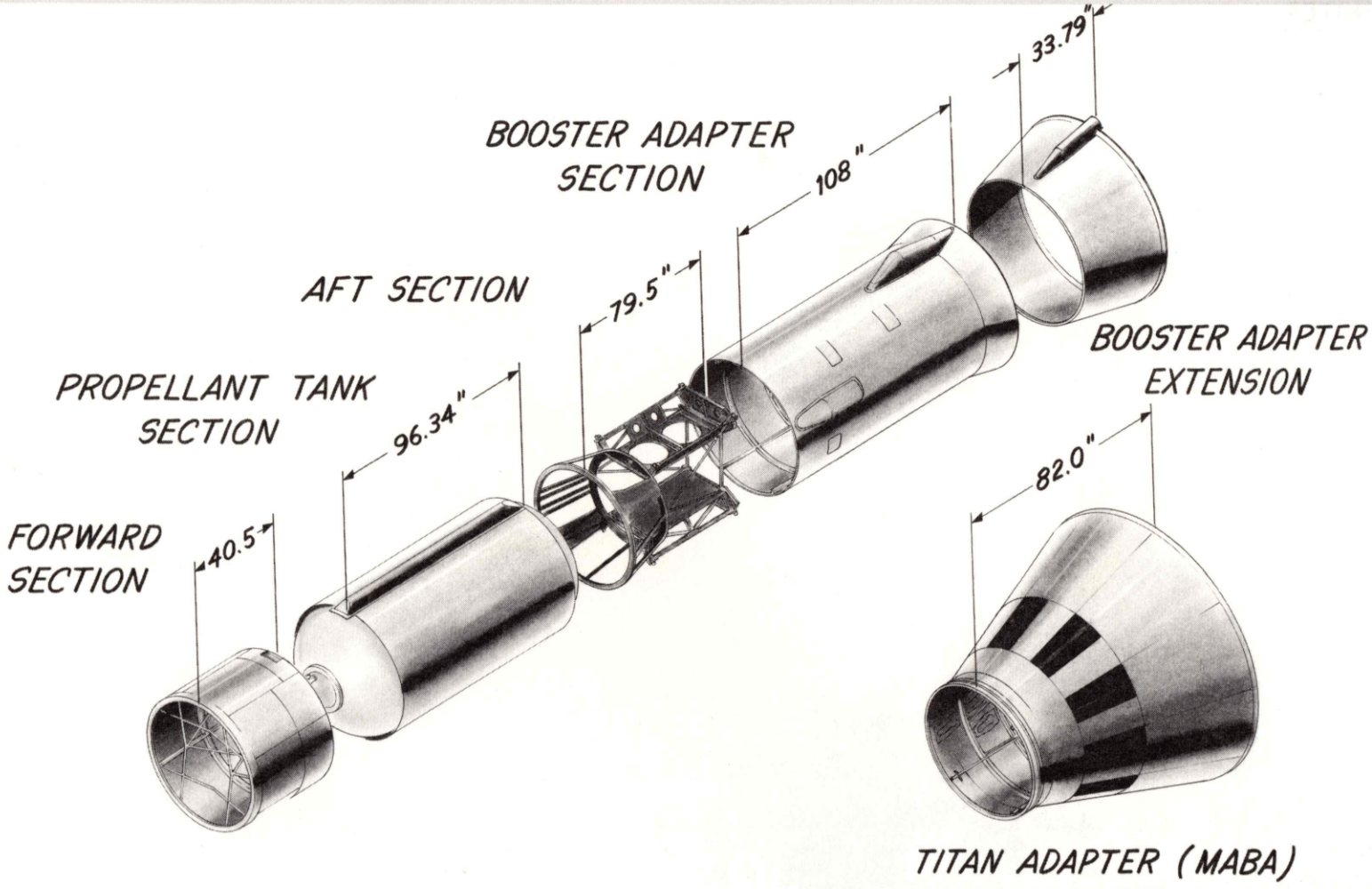
GEMINI SHROUD



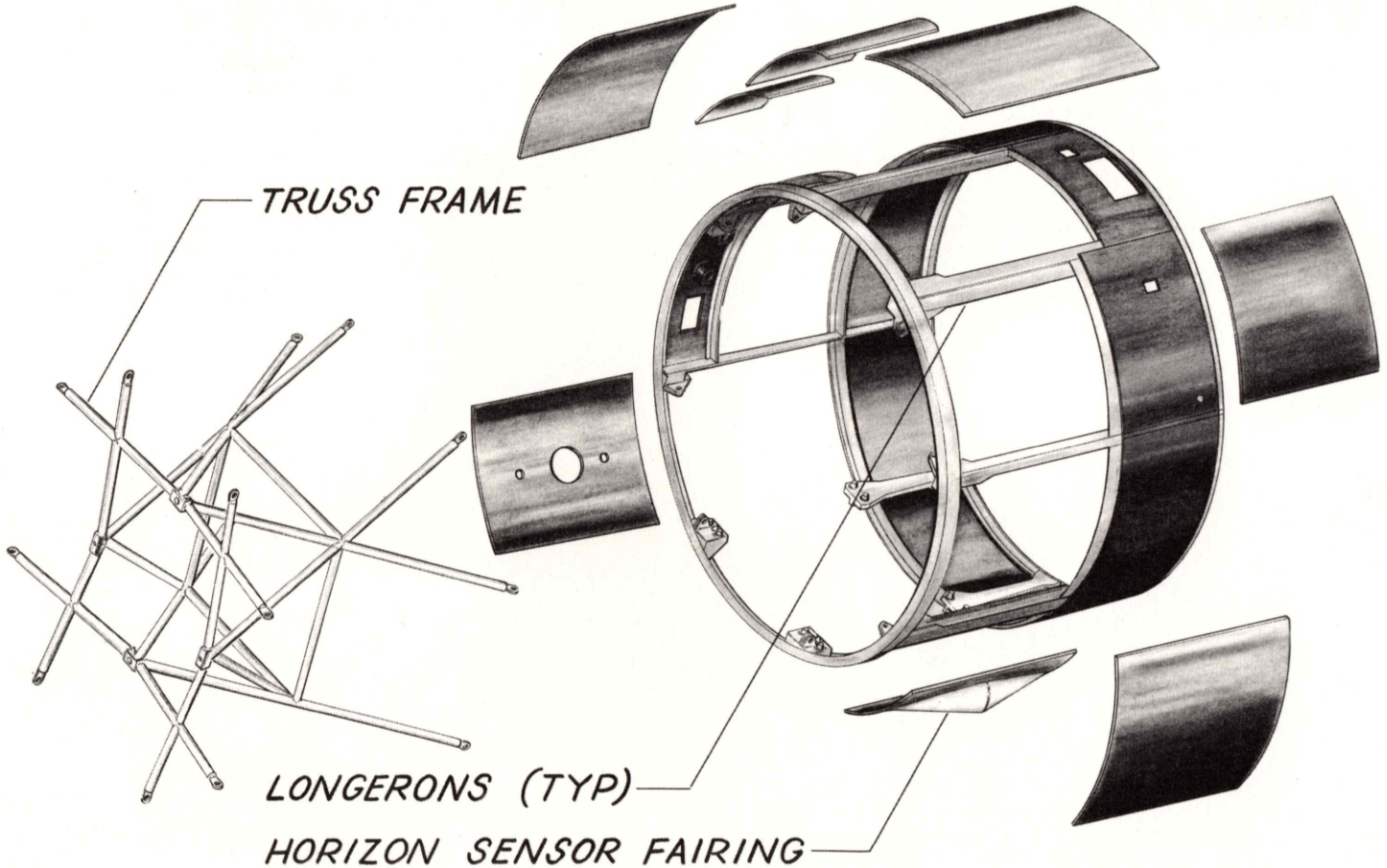
169 SHROUD CONFIGURATION



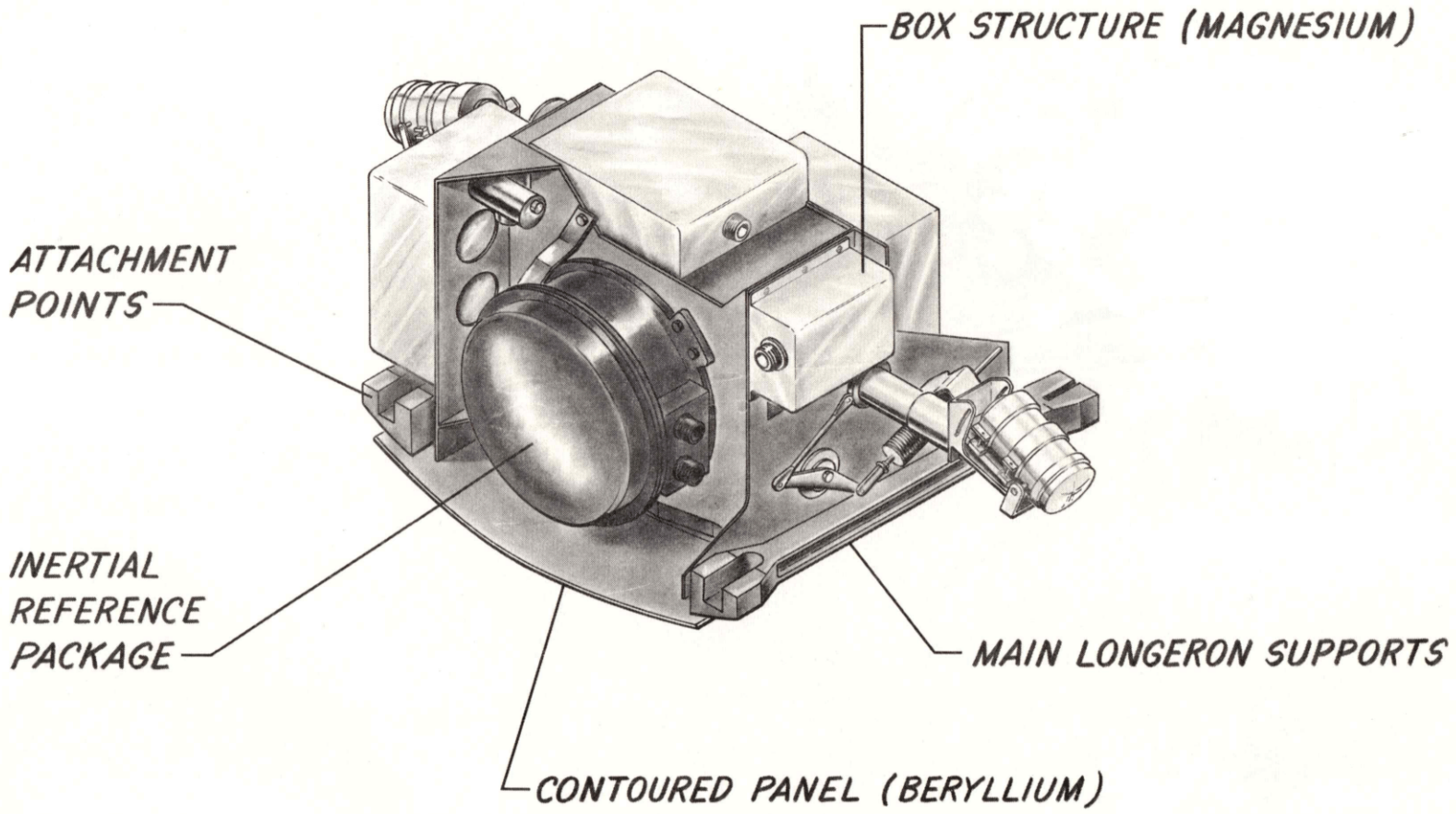
STANDARD AGENA SPACEFRAME



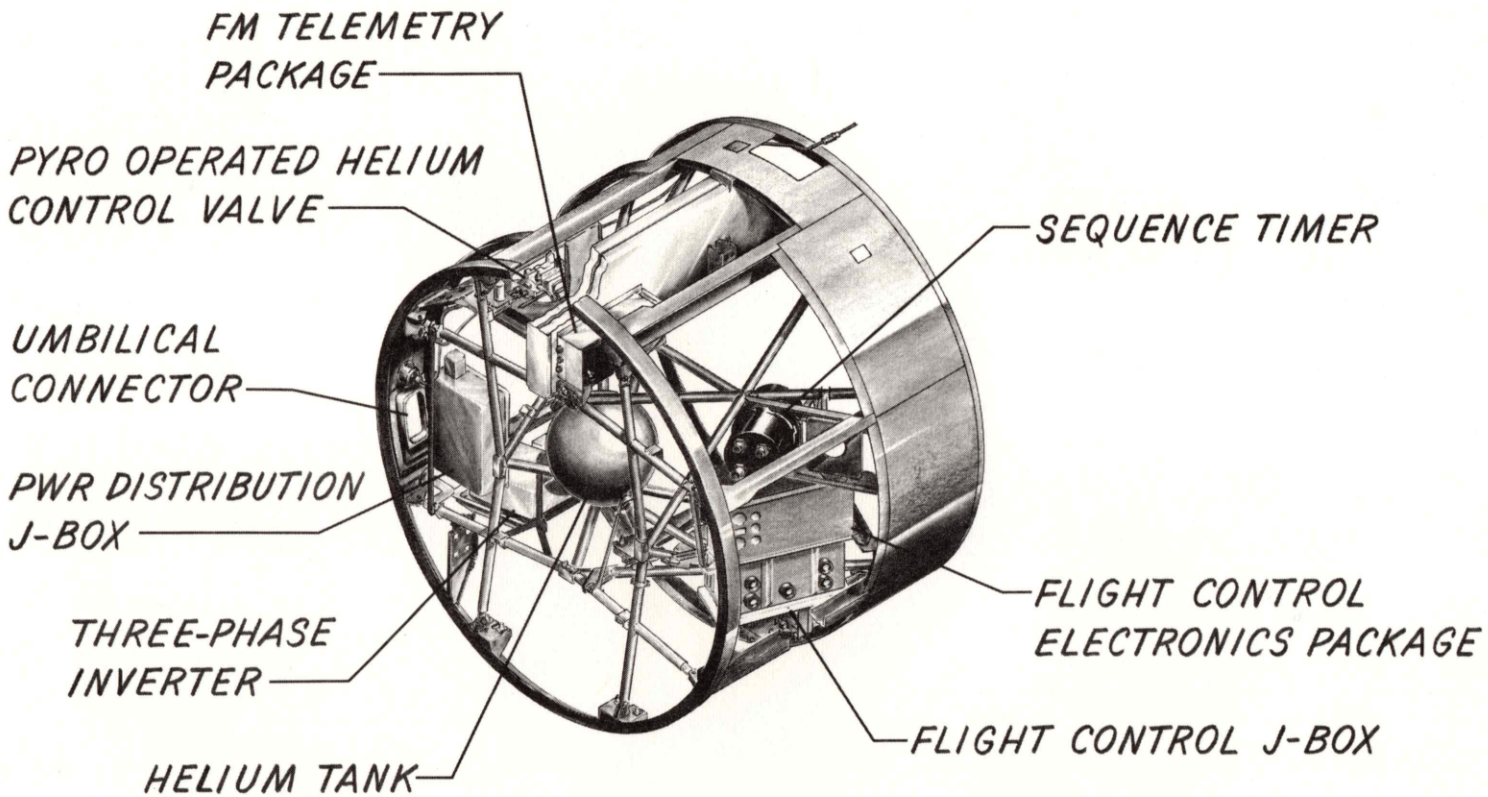
FORWARD SECTION EXPLODED VIEW



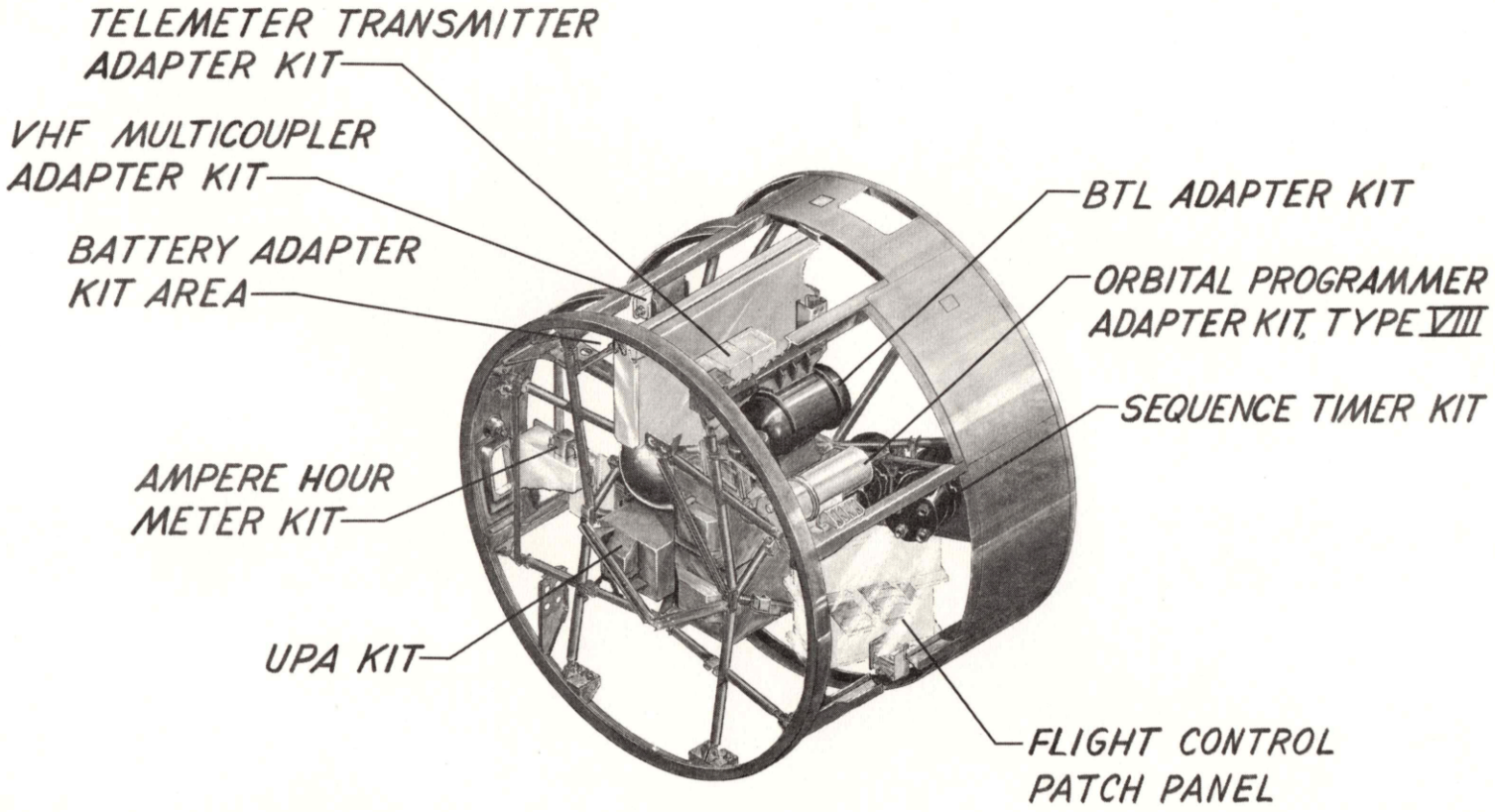
GUIDANCE MODULE STRUCTURE



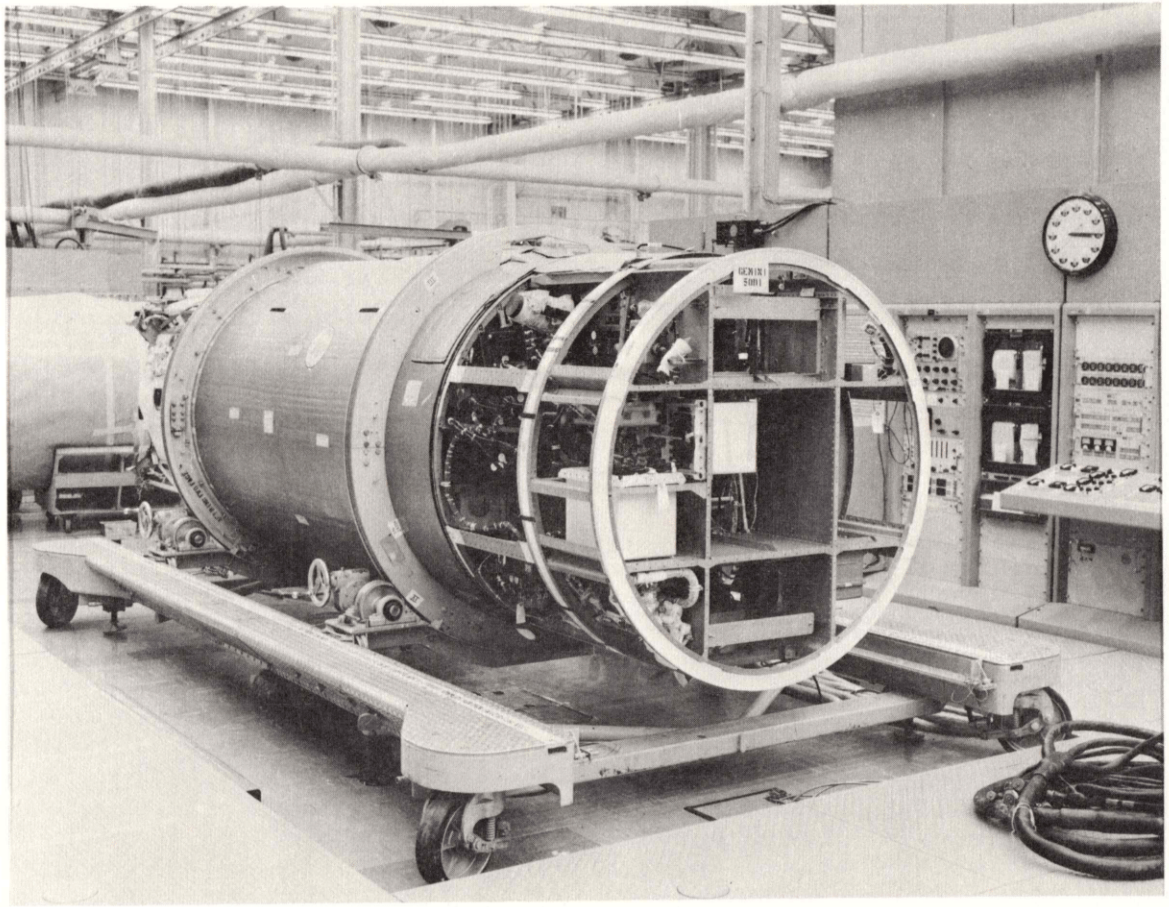
FORWARD SECTION - BASIC CONFIG



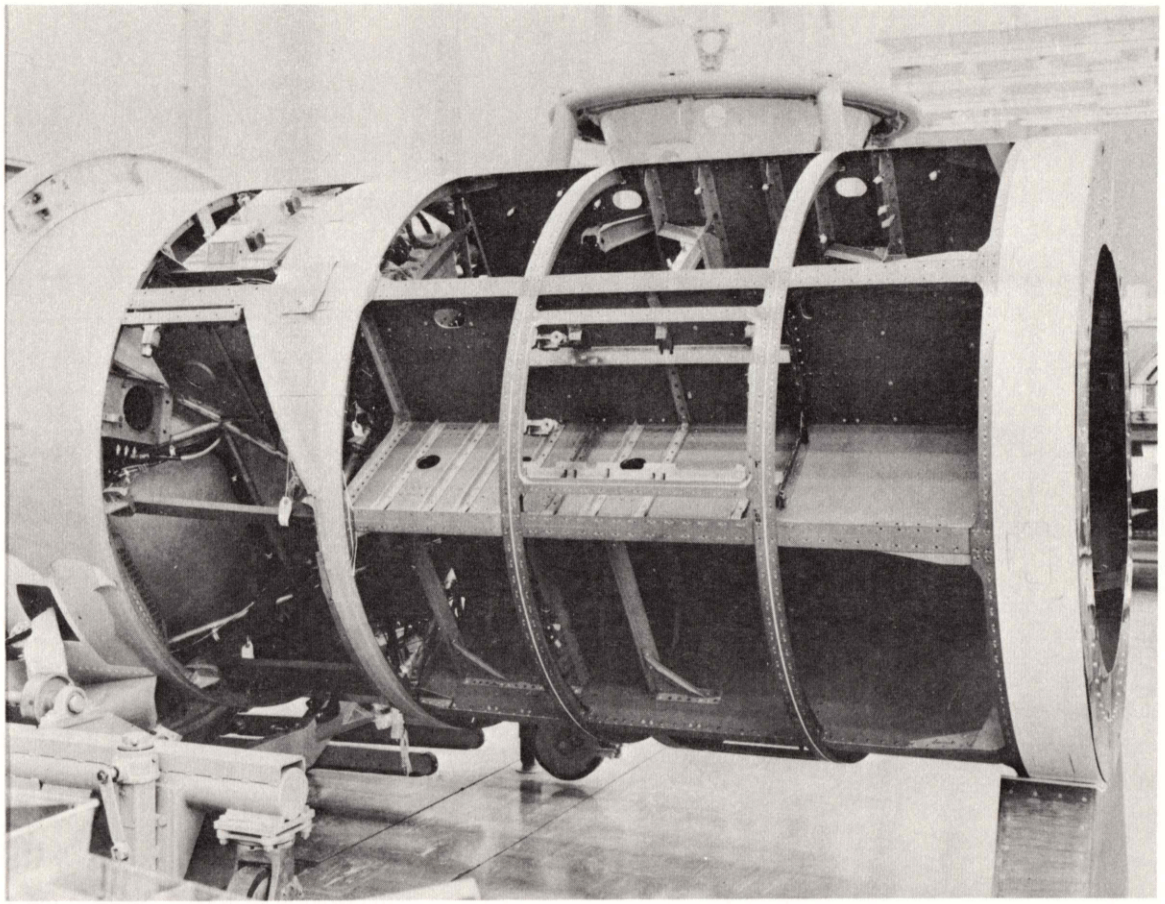
FWD SECTION-OPTIONAL CONFIGURATION



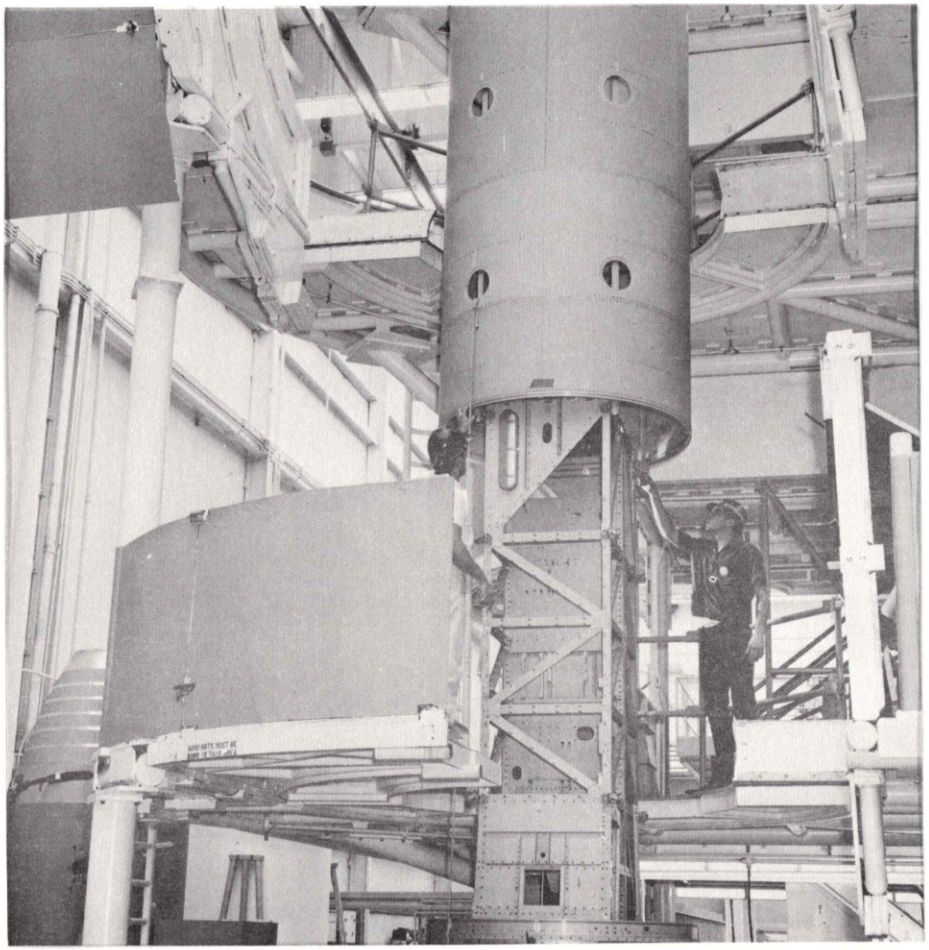
AUXILIARY FWD SECTION-GEMINI



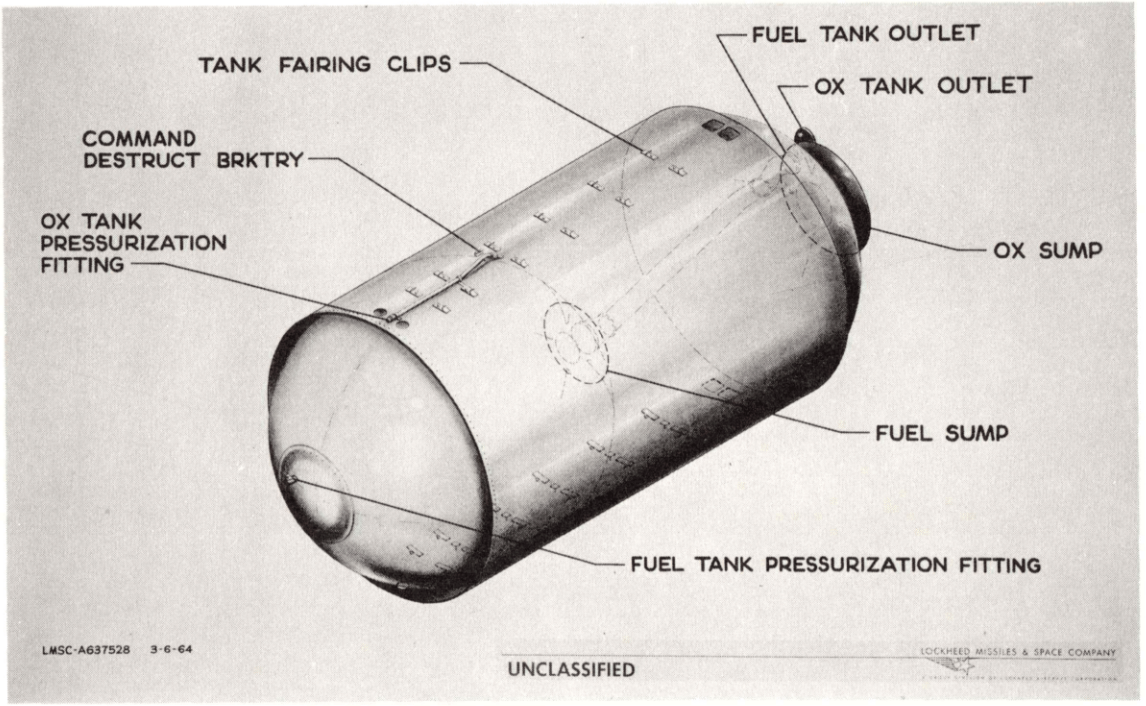
AUXILIARY FORWARD SECTION - SNAPSHOT



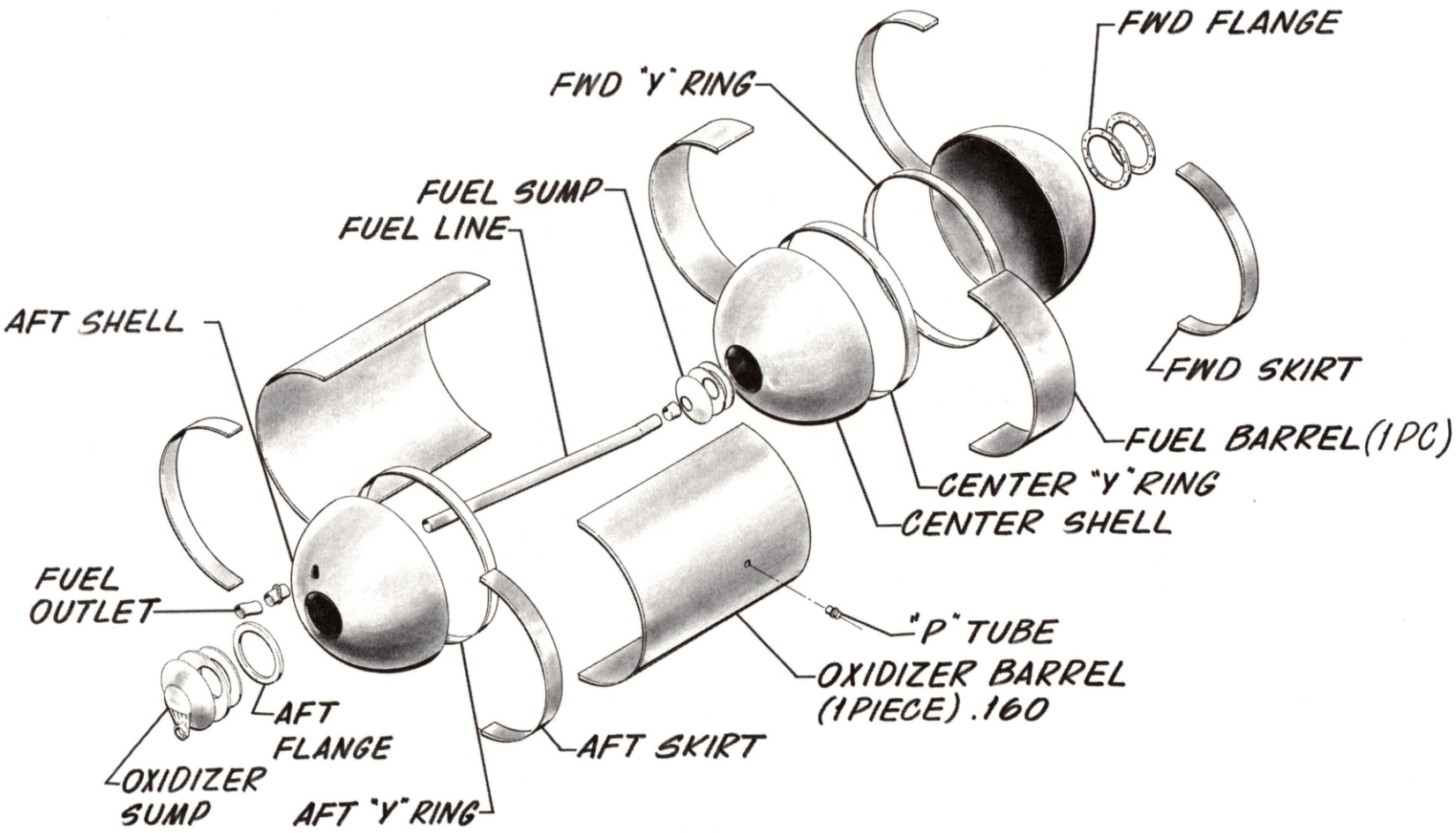
AUXILIARY FWD SECTION - PROGRAM 461



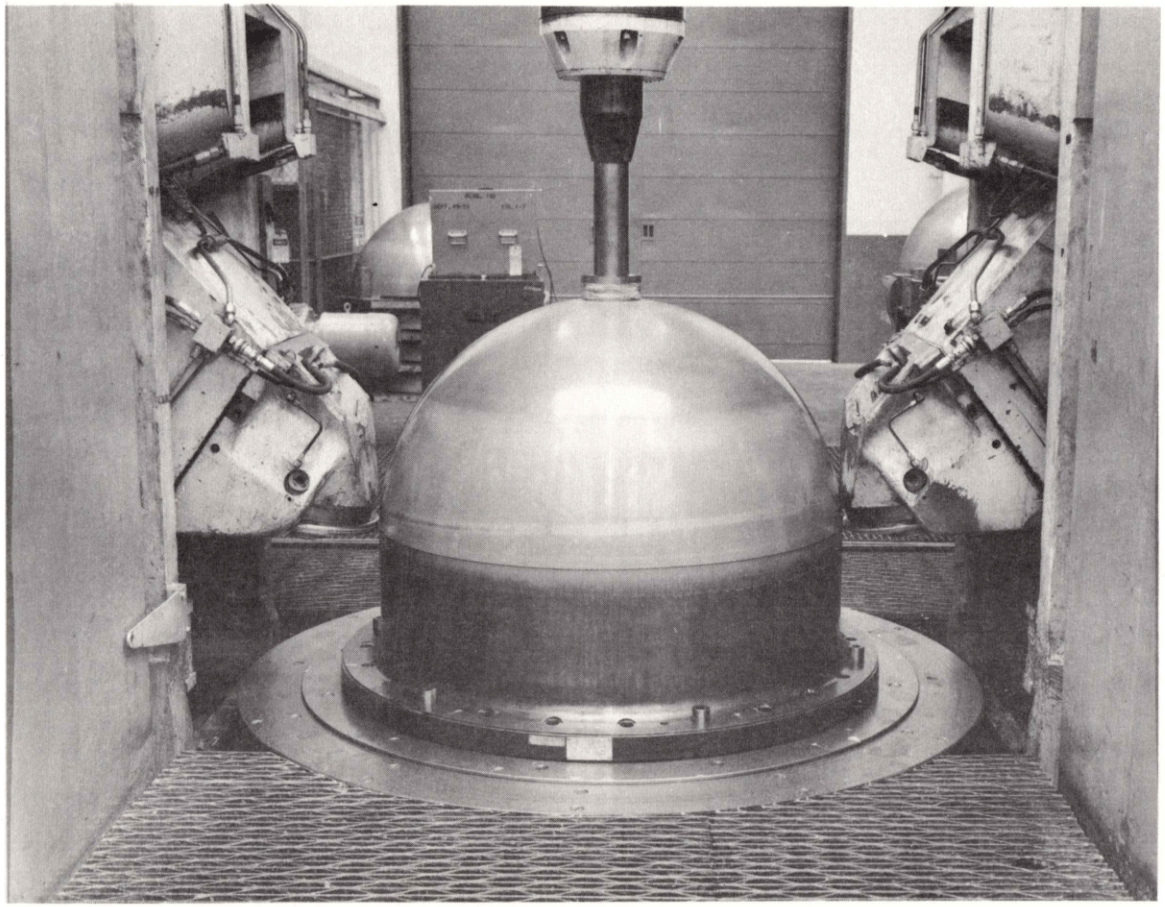
TANK SECTION



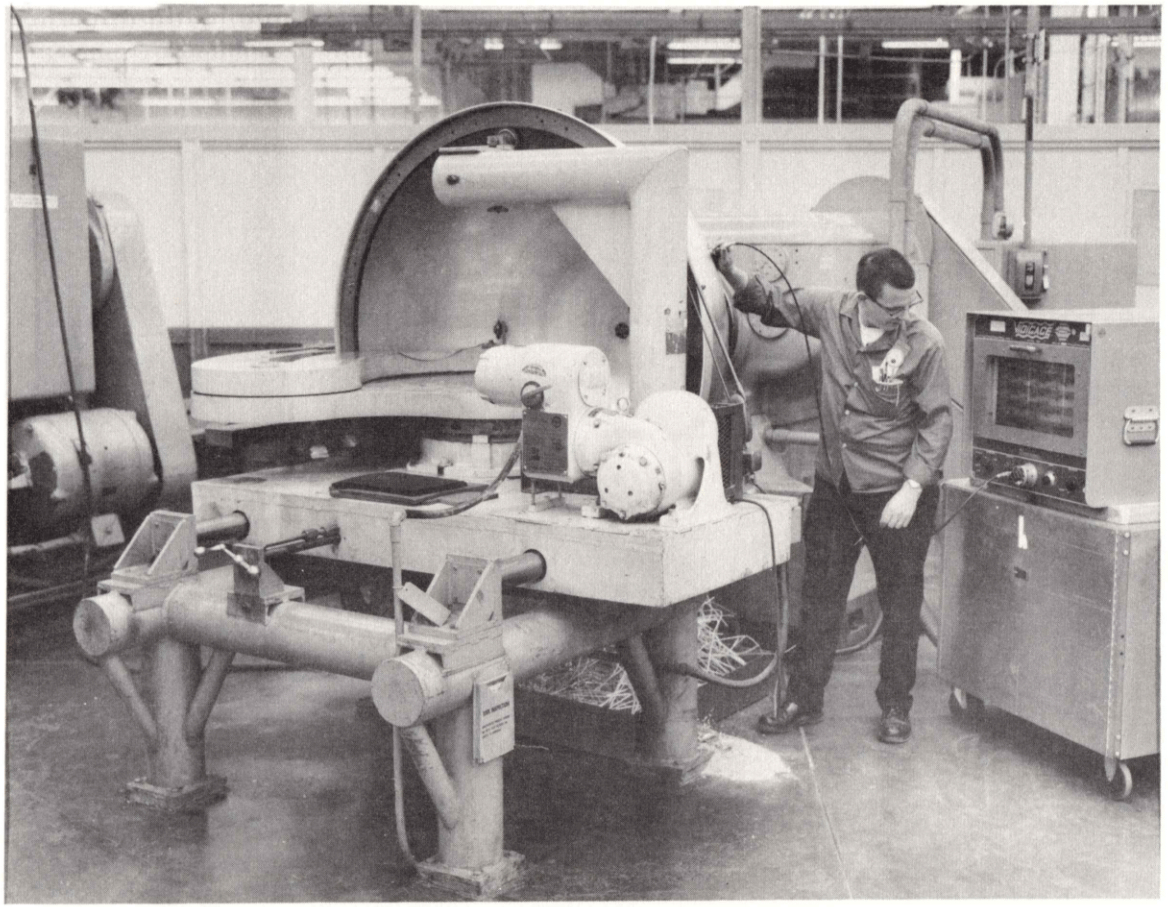
STANDARD AGENA PROPELLANT TANK



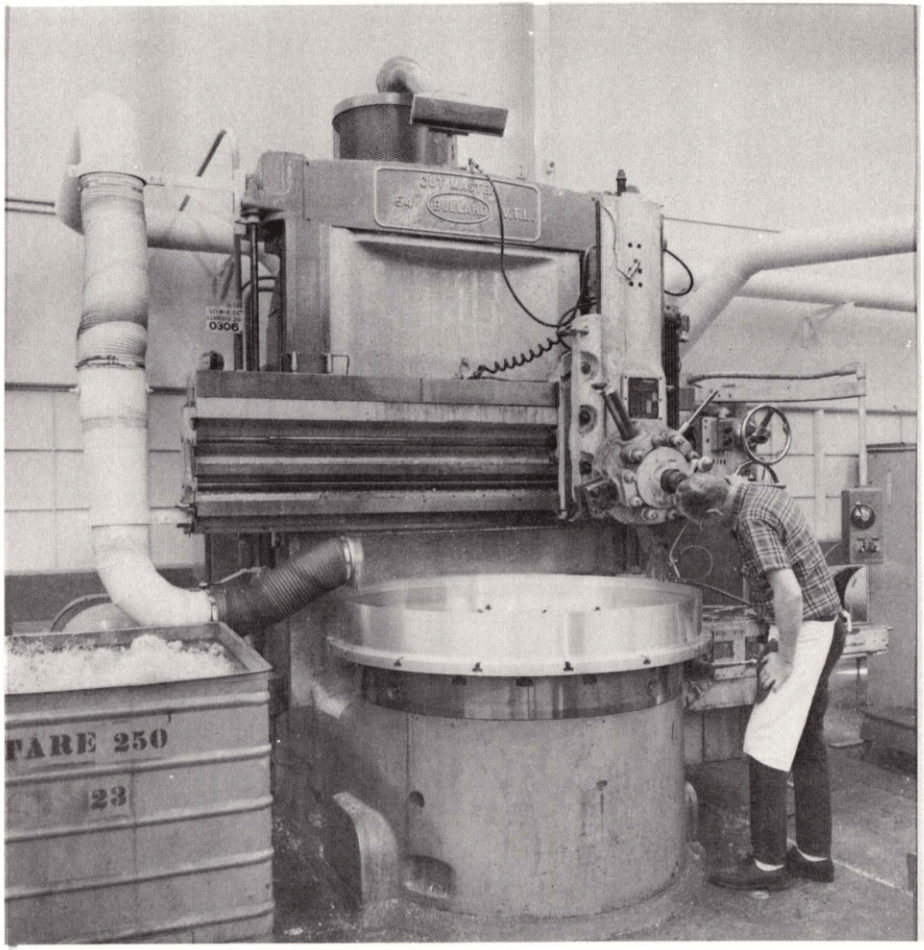
SHEAR FORMING HEMISPHERES



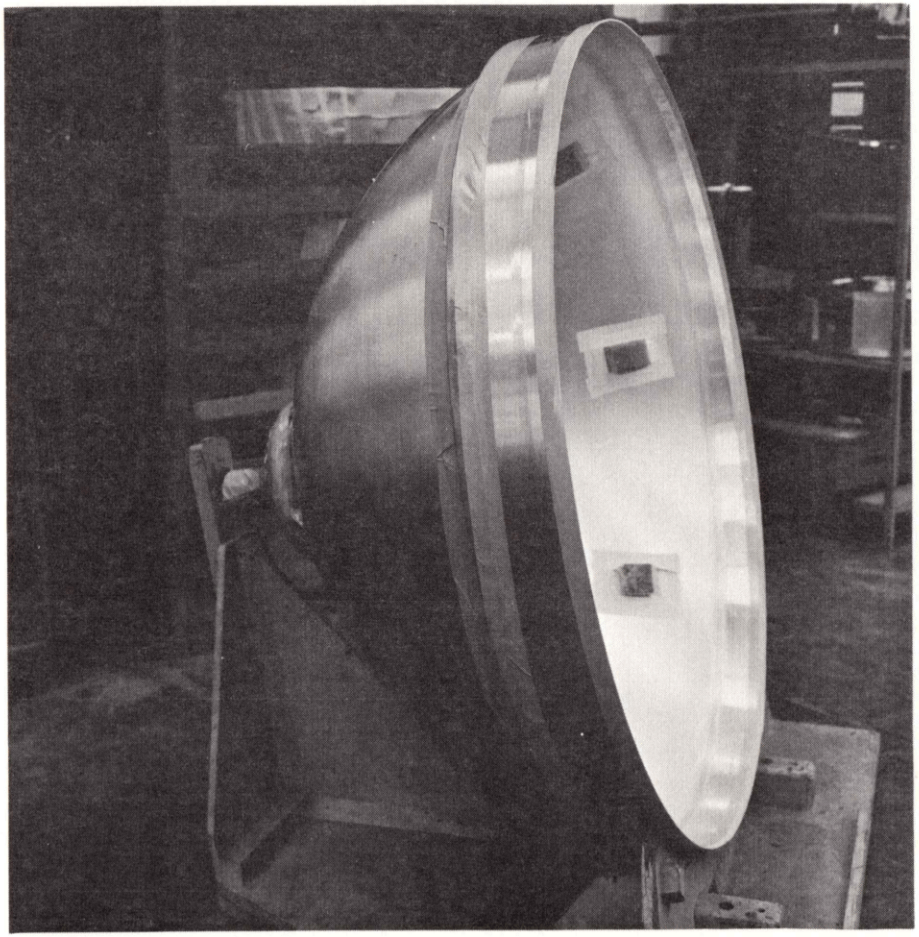
FINAL MACHINING & GAGING OF HEMISPHERES



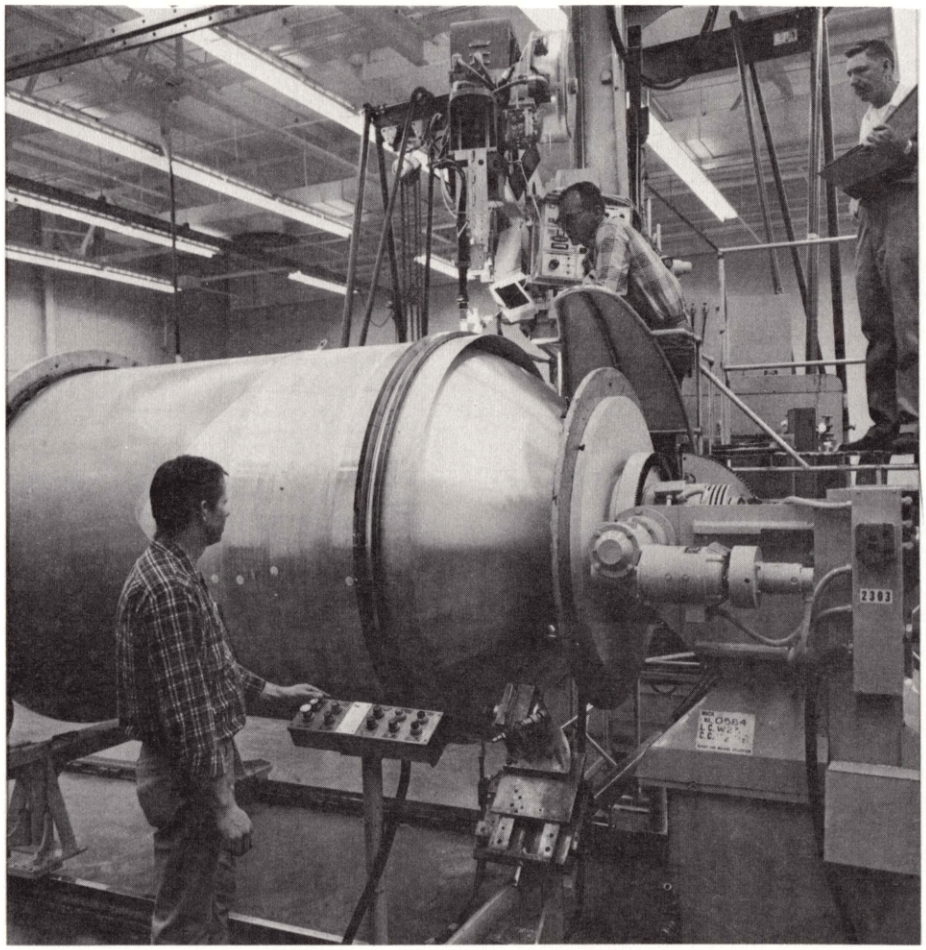
MACHINING OF Y-RINGS



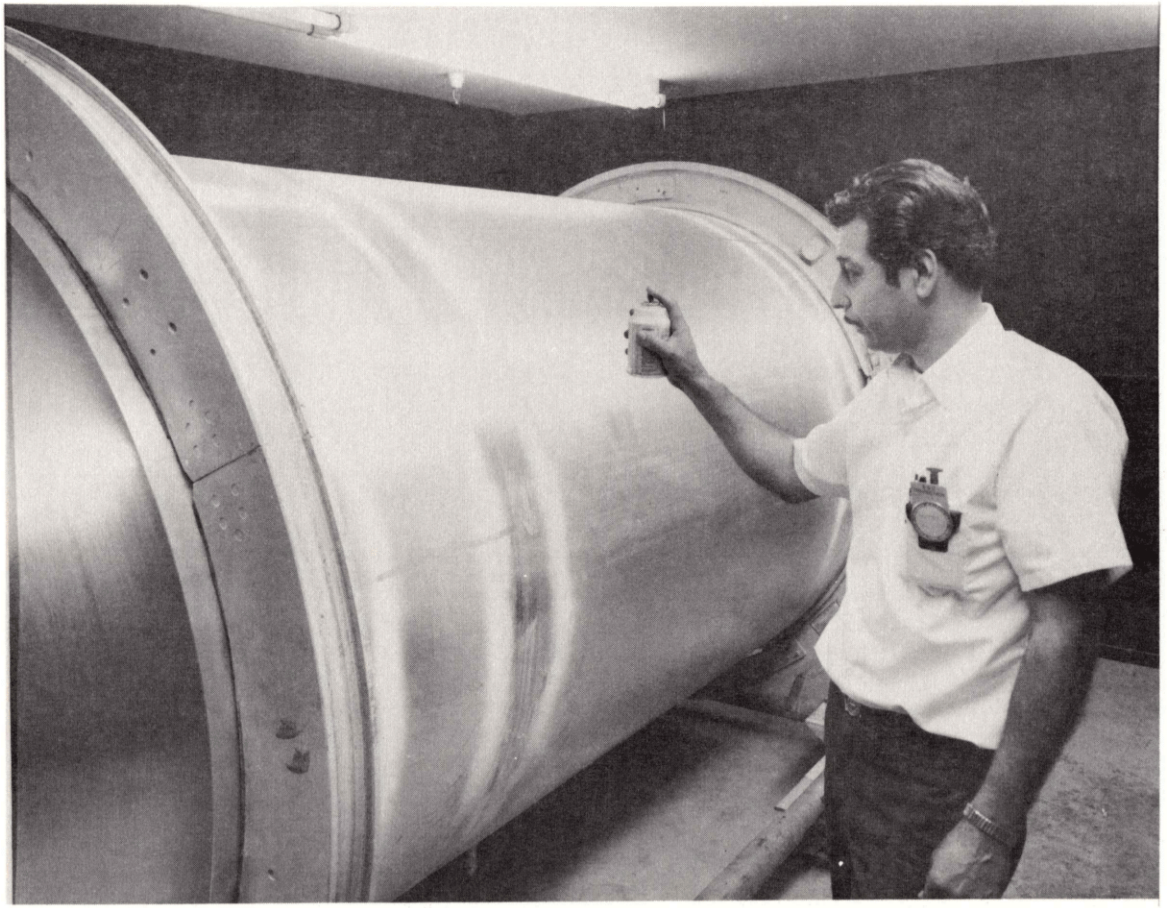
FUEL LOWER HEMISPHERE



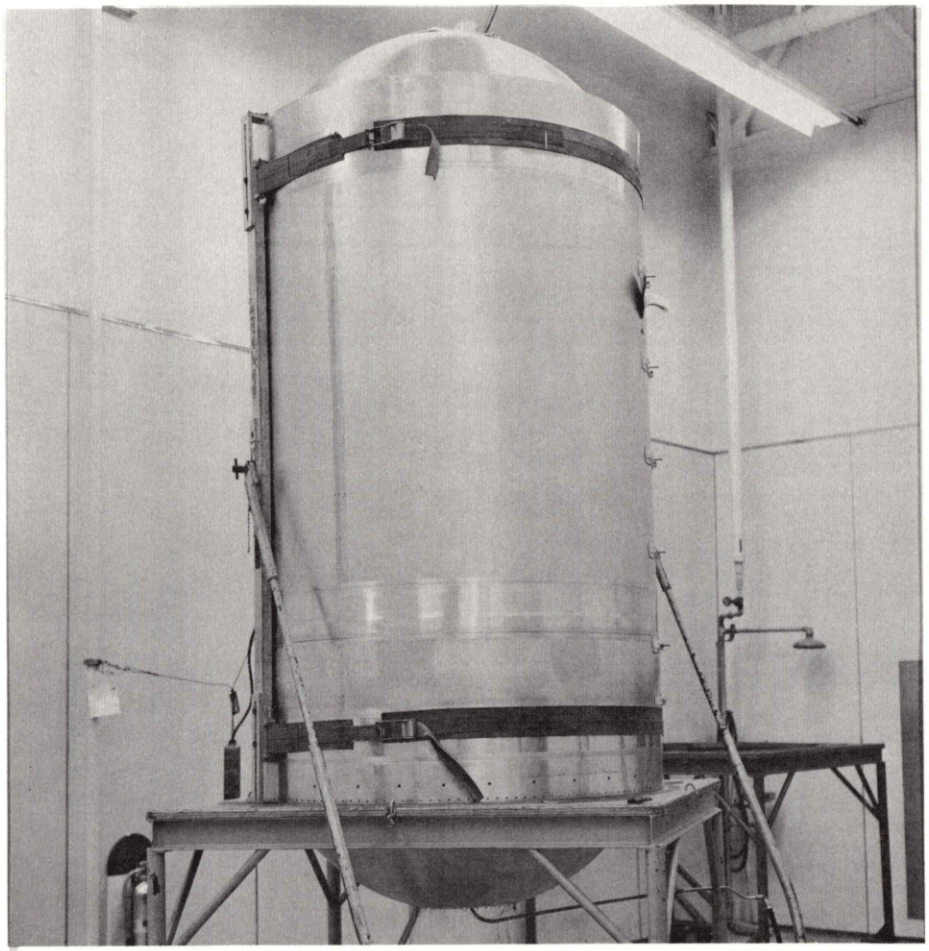
CIRCUMFERENTIAL ASSEMBLY WELD



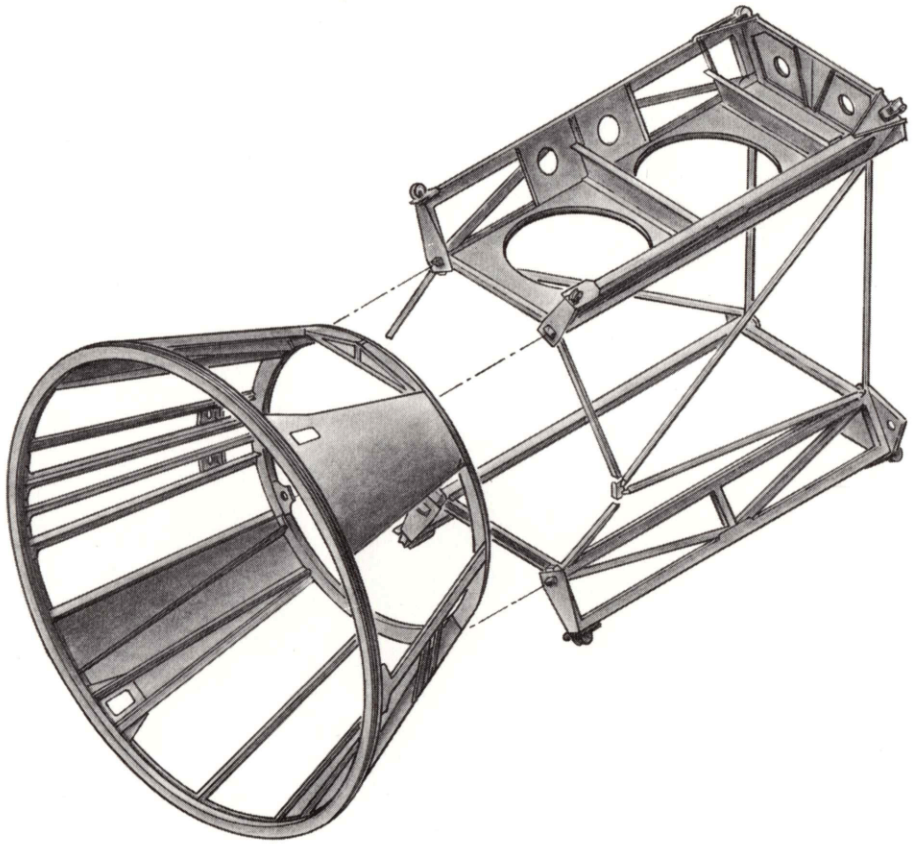
DYE PENETRANT CHECK



TANK FINAL CLEANING

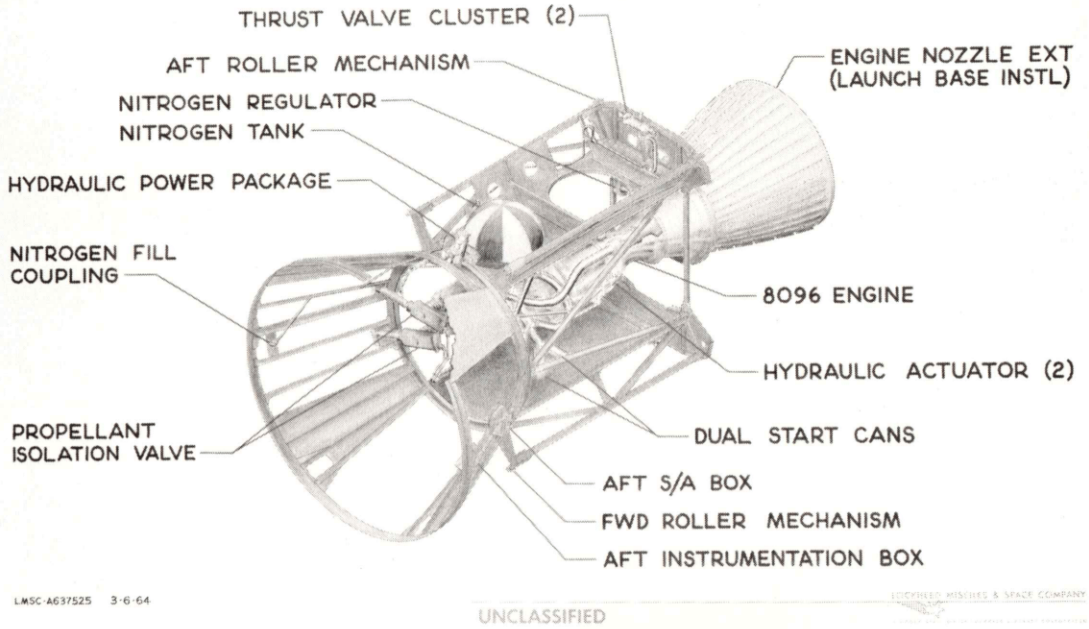


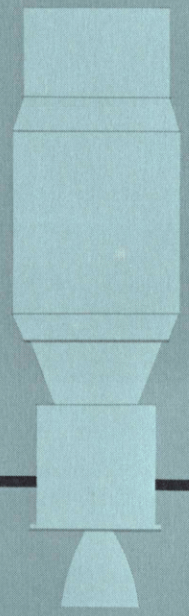
AFT SECTION FRAMEWORK



AFT SECTION

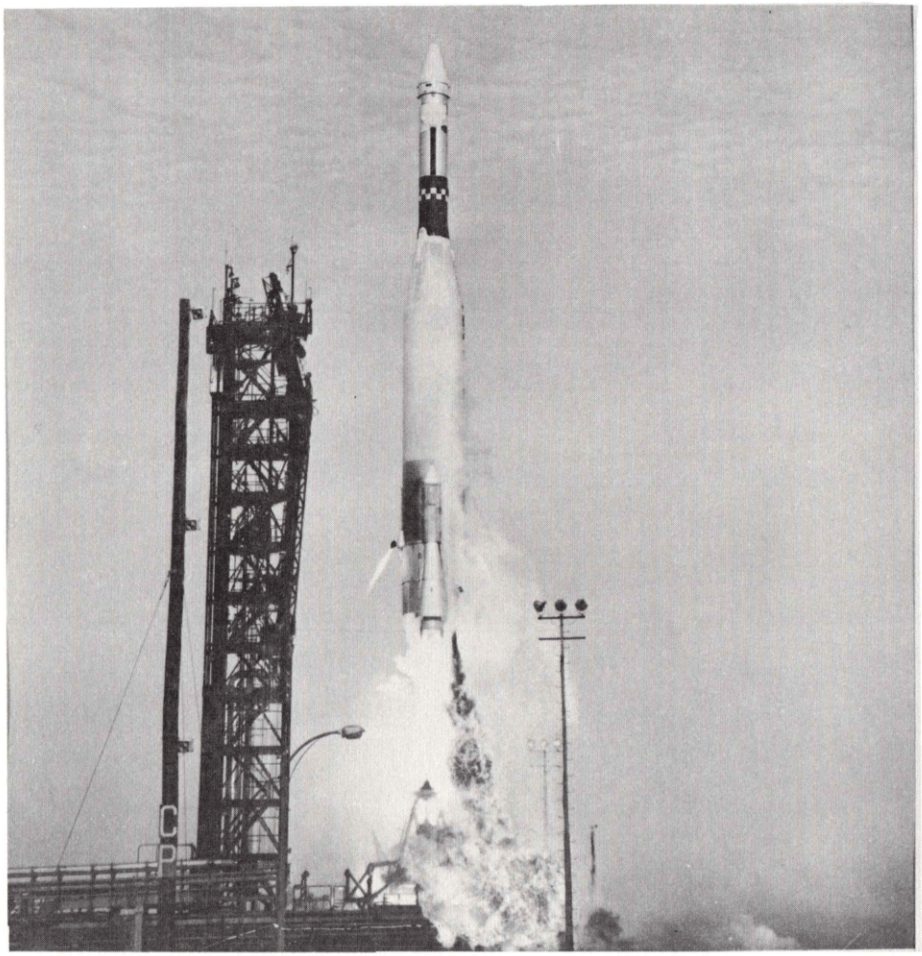
BASIC VEHICLE



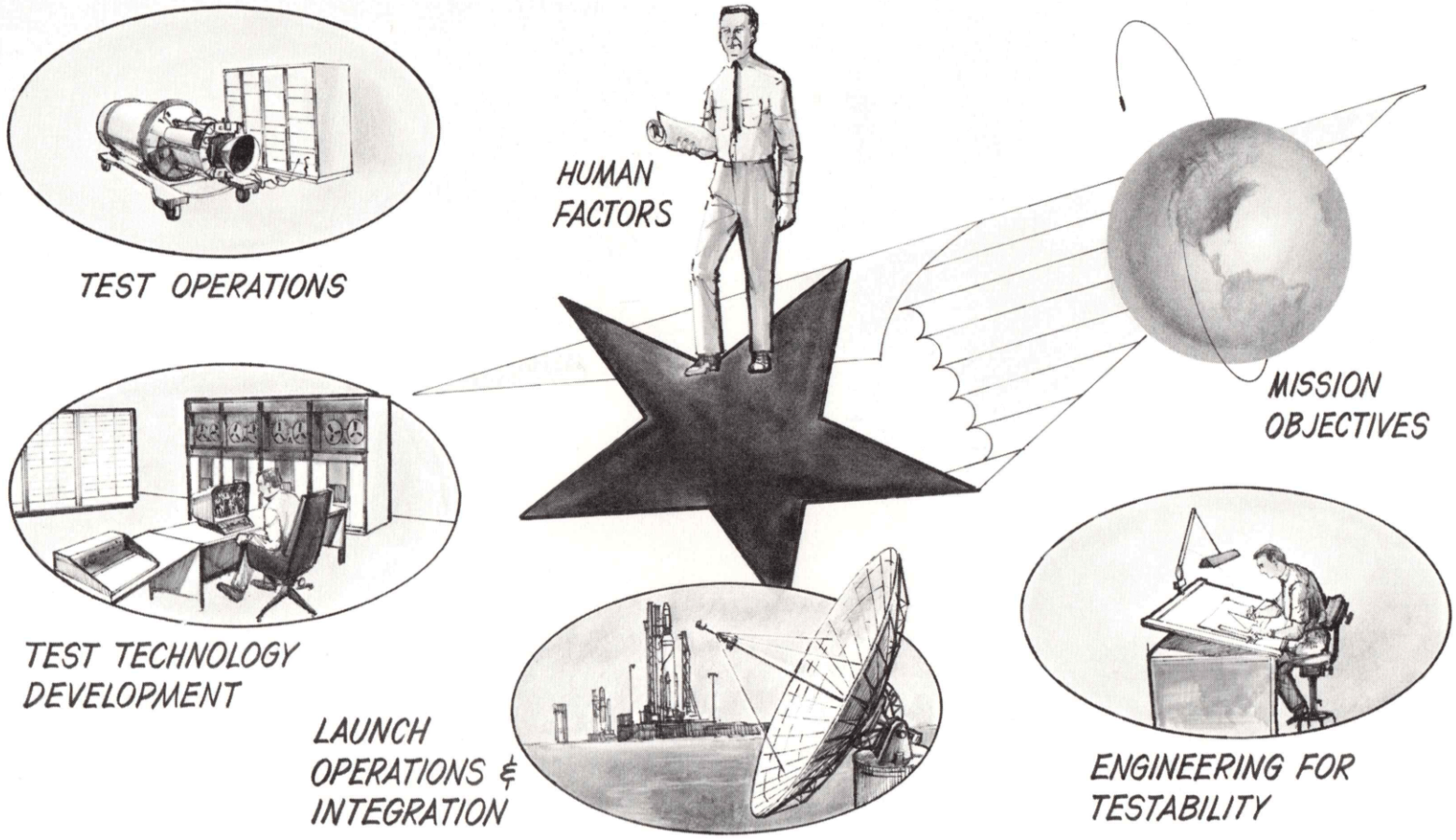


SYSTEMS OPERATIONS

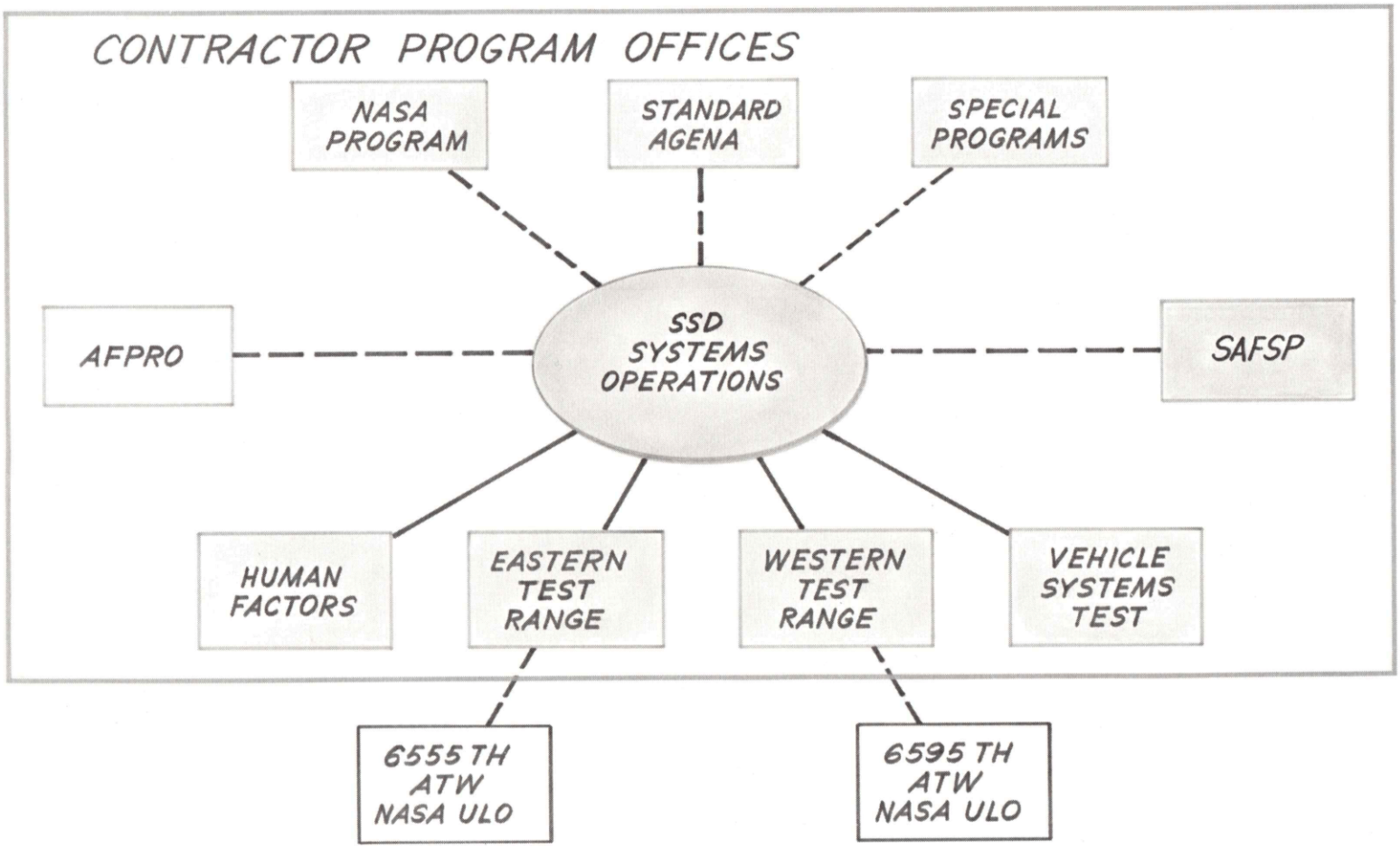
AGENA LAUNCH



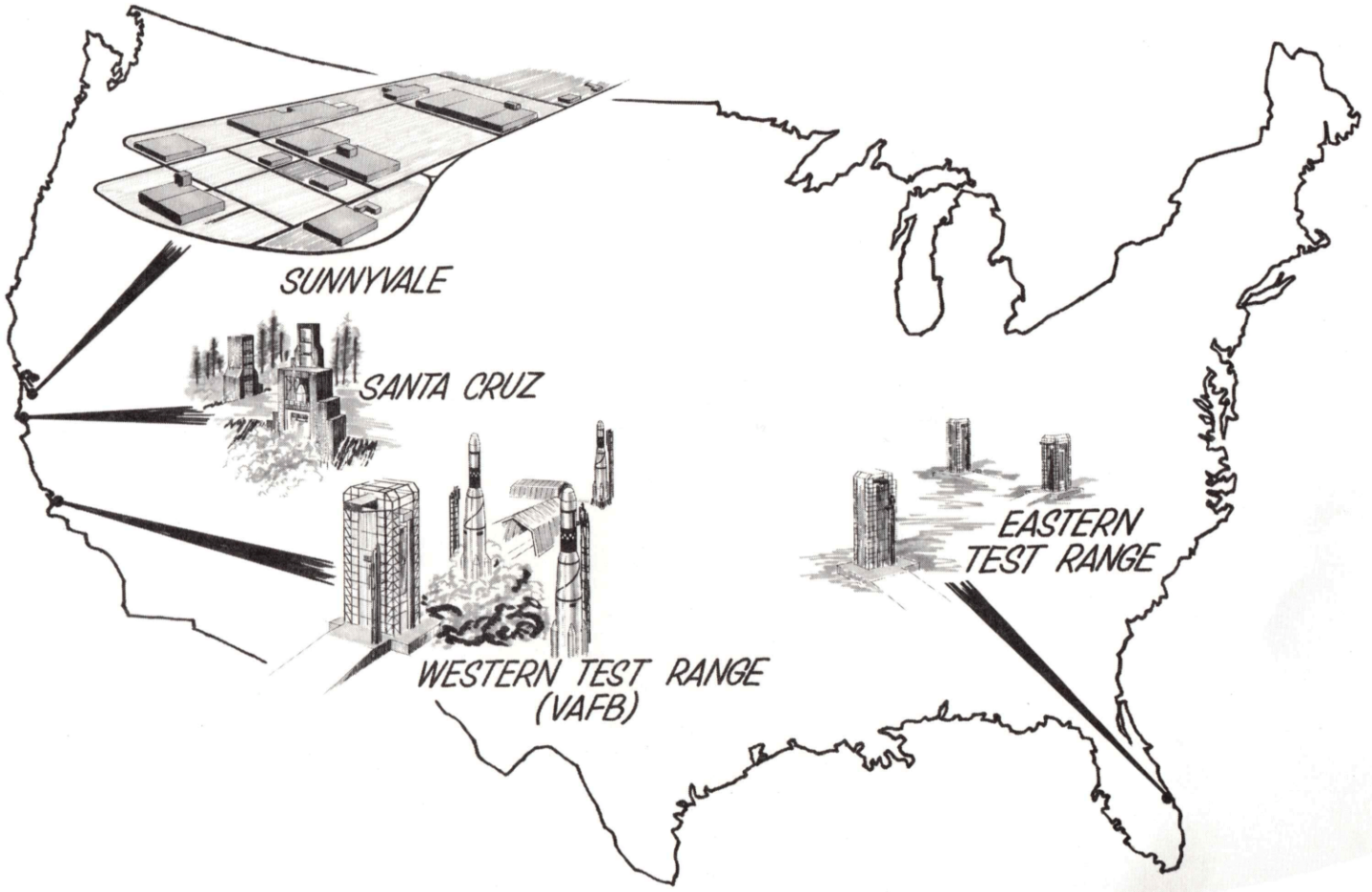
SYSTEMS OPERATIONS-ACTIVITIES



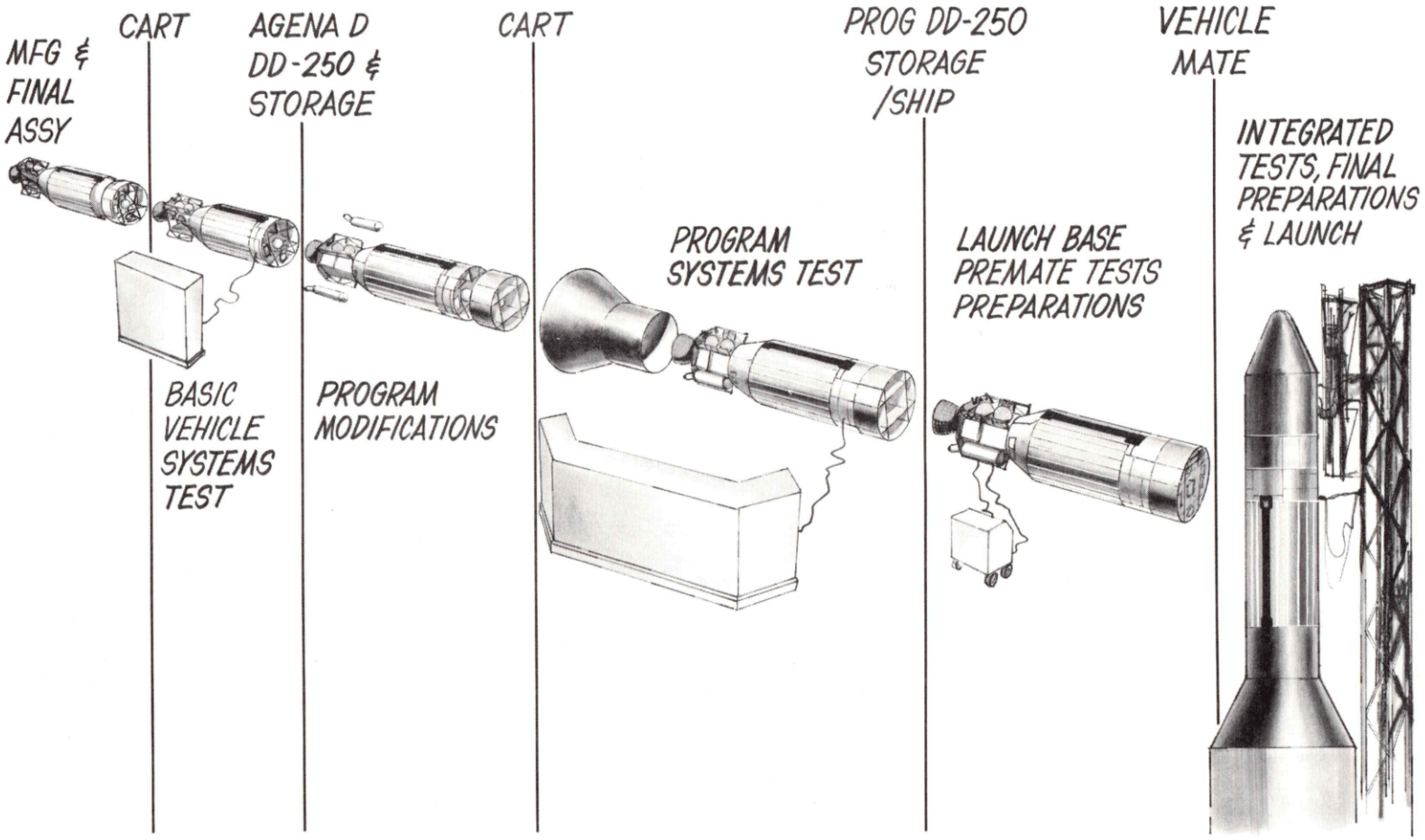
SYSTEMS OPERATIONS – INTEGRATION



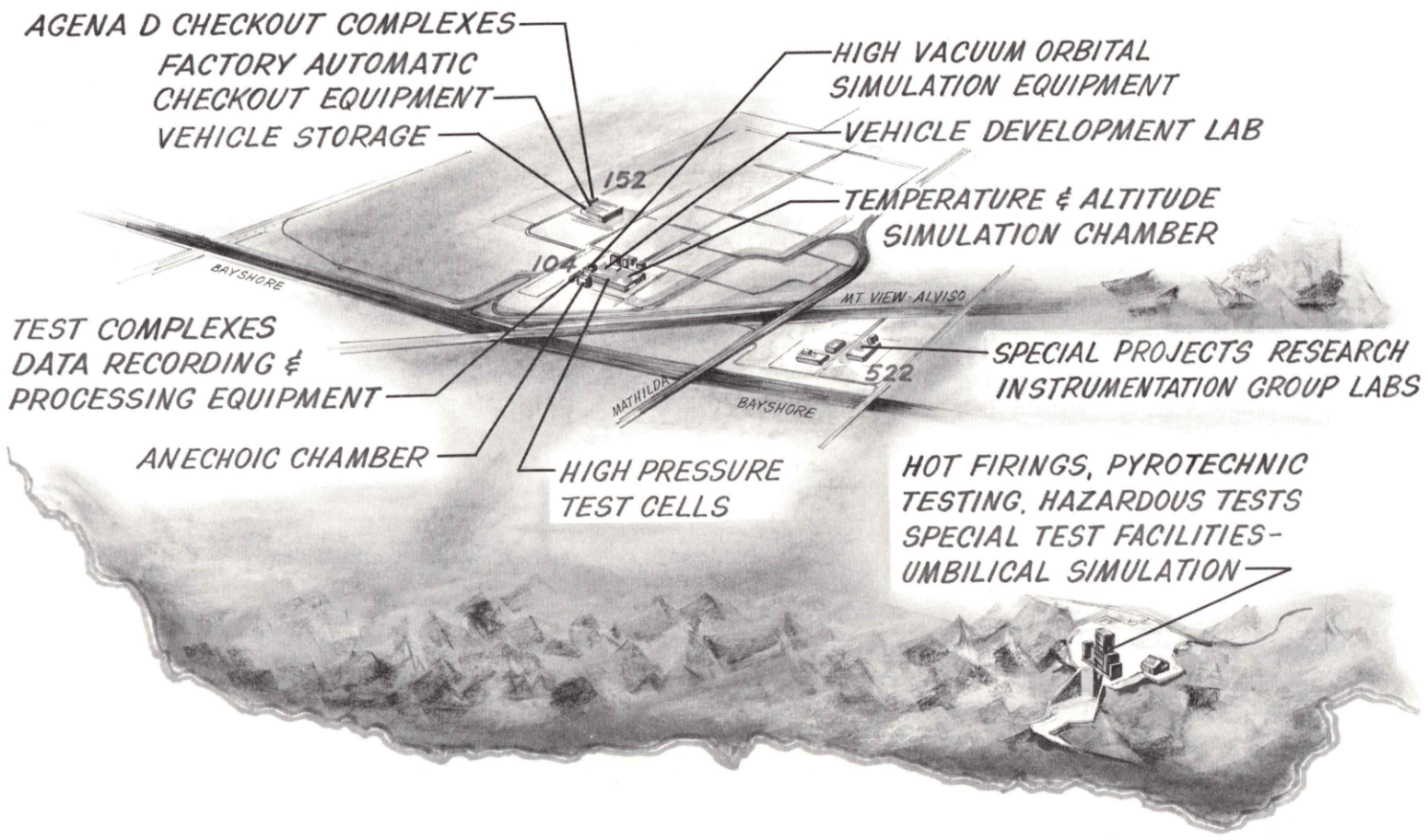
SYSTEMS OPERATIONS



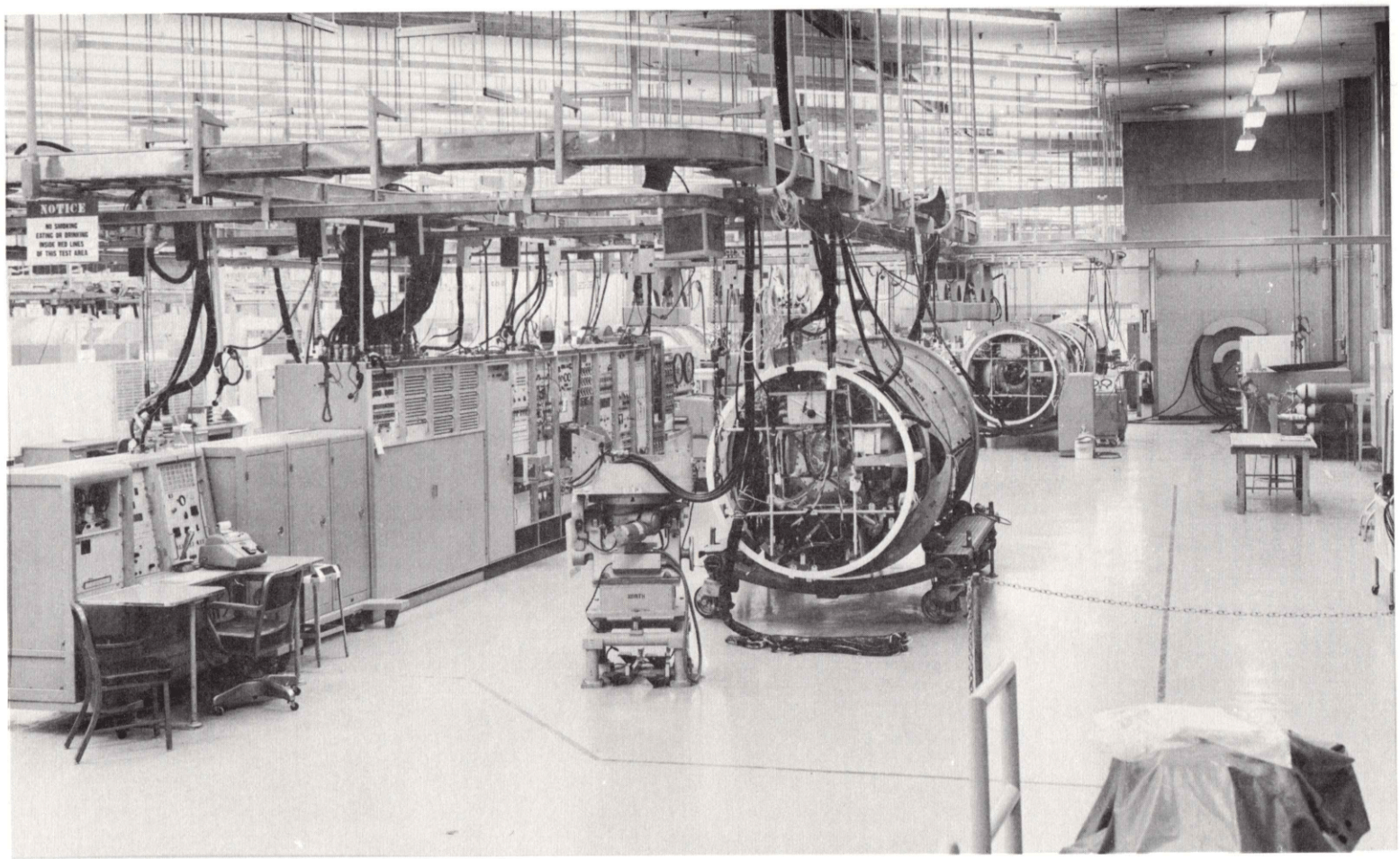
AGENA FACTORY-LAUNCH SEQUENCE



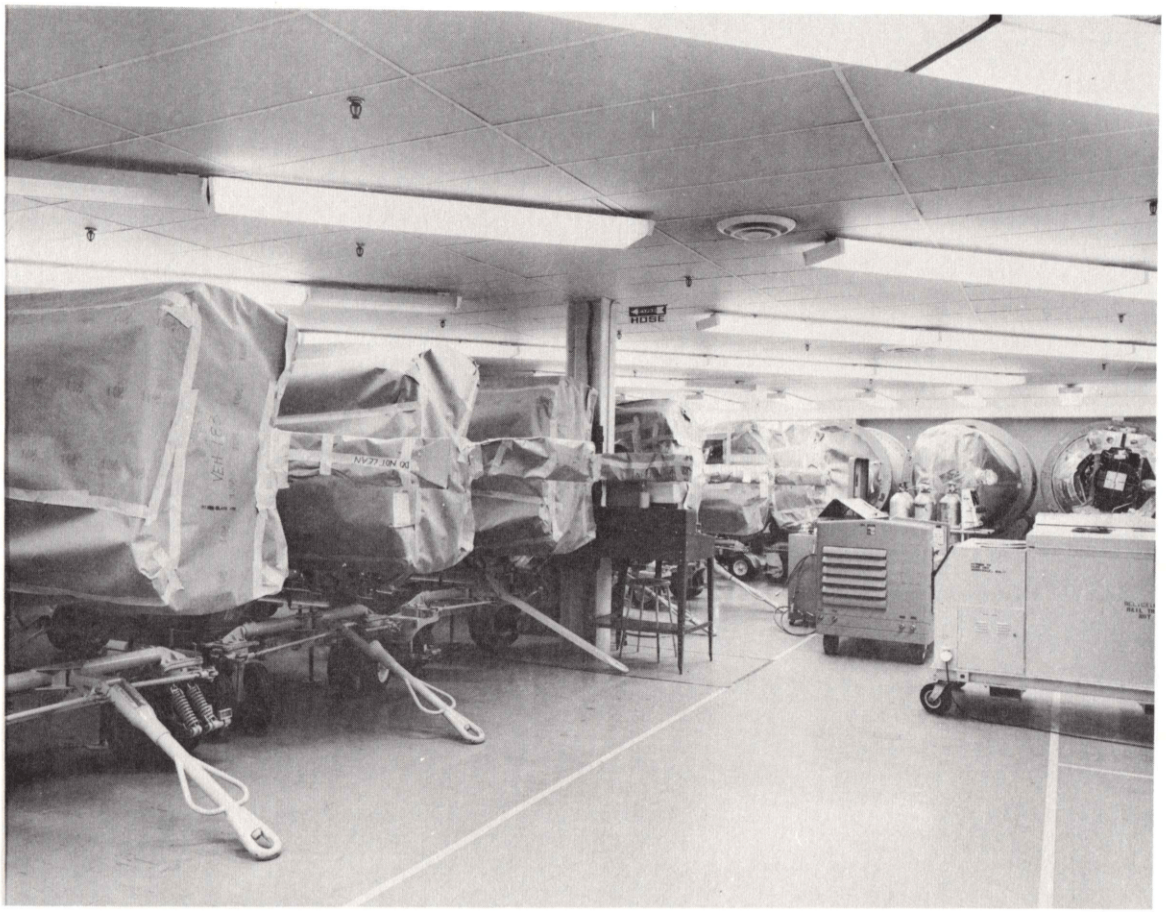
VEHICLE SYSTEMS TEST



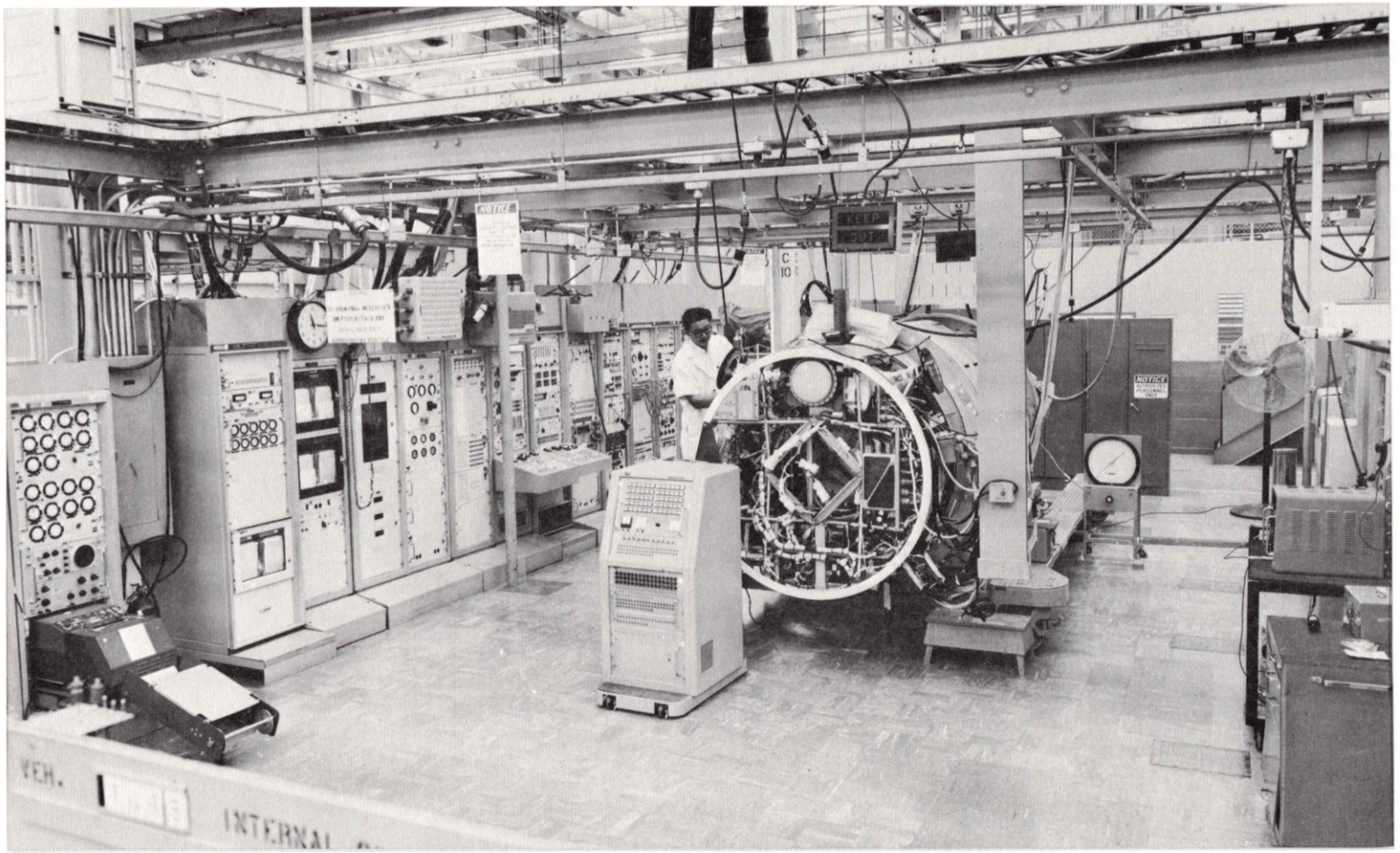
AREA 54 – SYSTEMS TEST



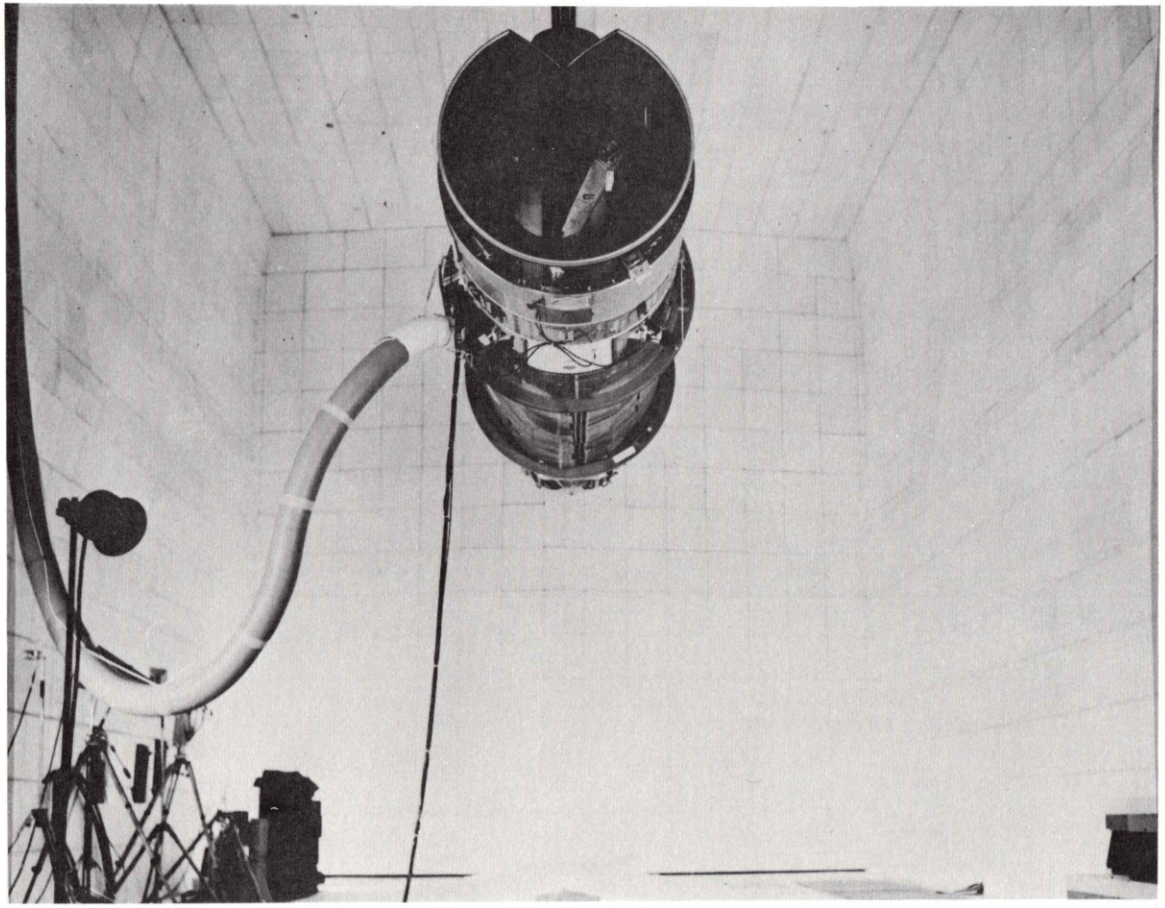
VEHICLE STORAGE



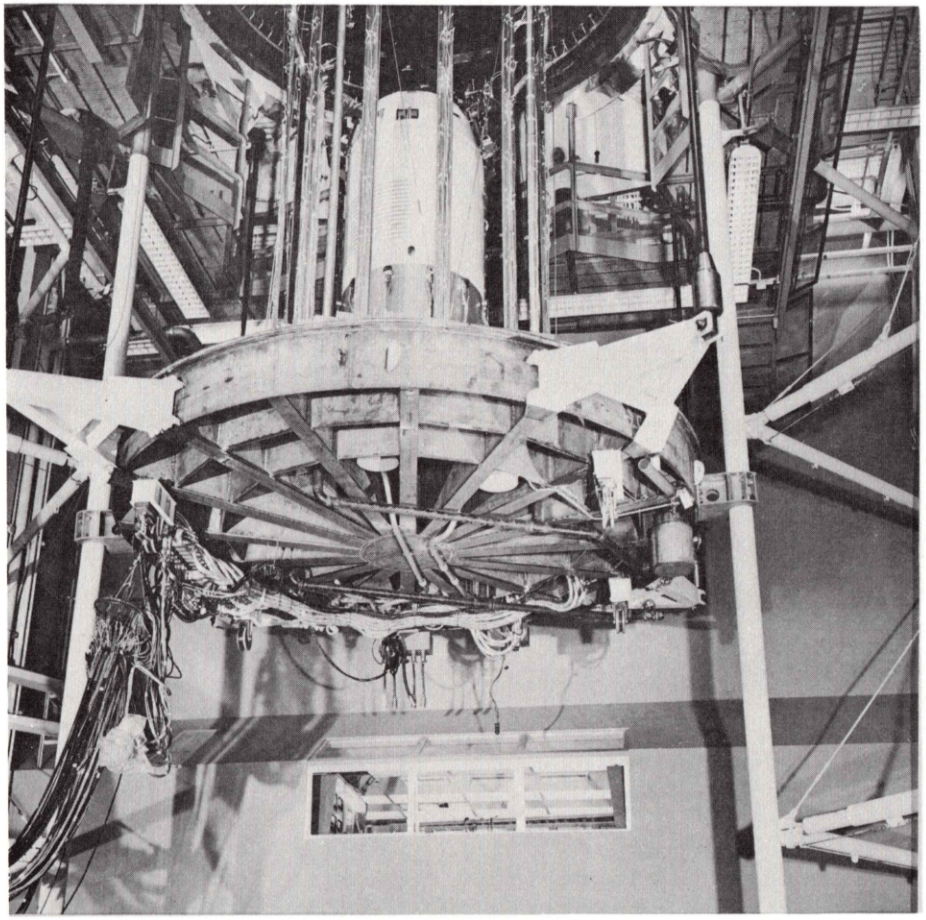
AREA 40 - AGENA TEST COMPLEX



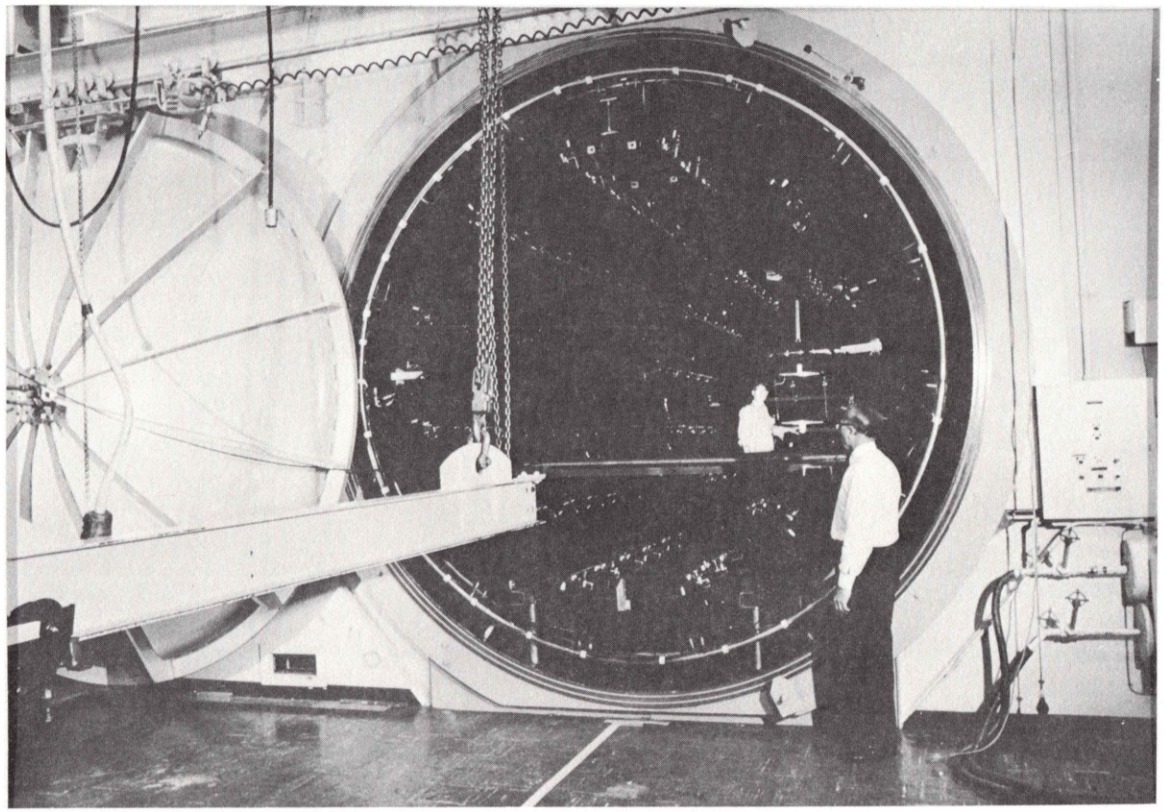
ANECHOIC CHAMBER



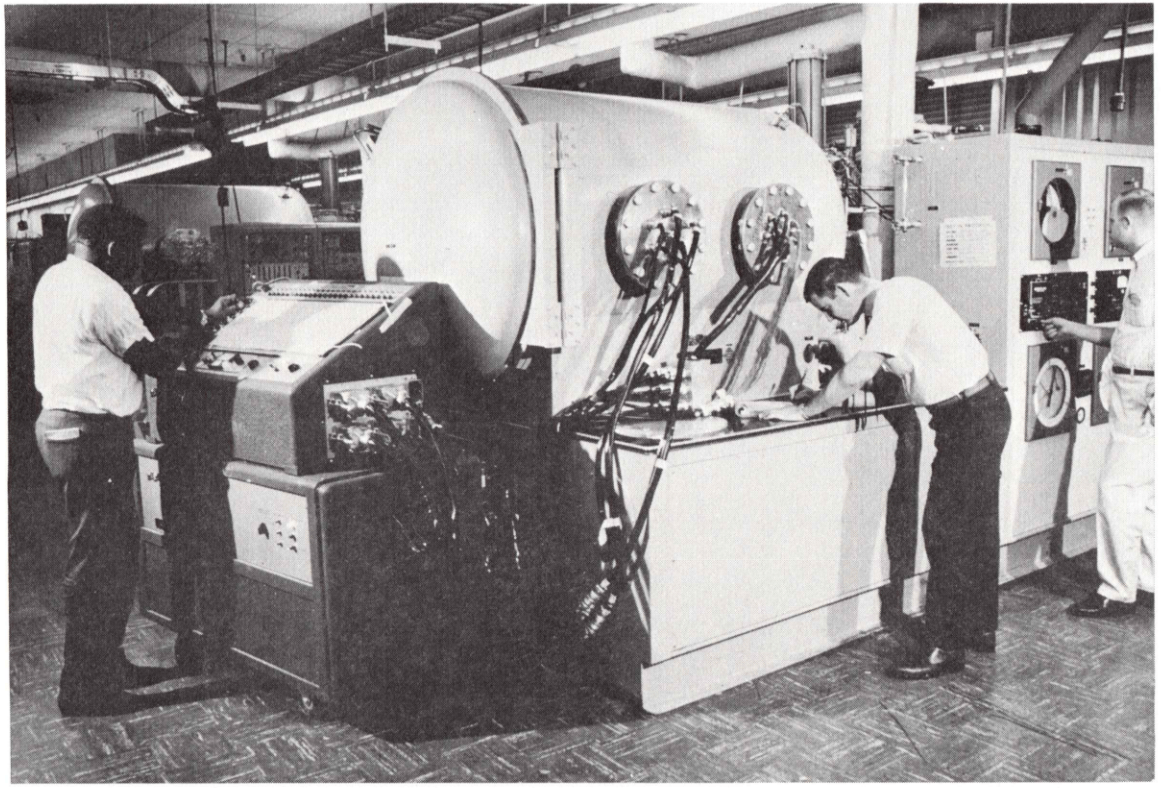
HIGH VACUUM ORBITAL SIMULATOR



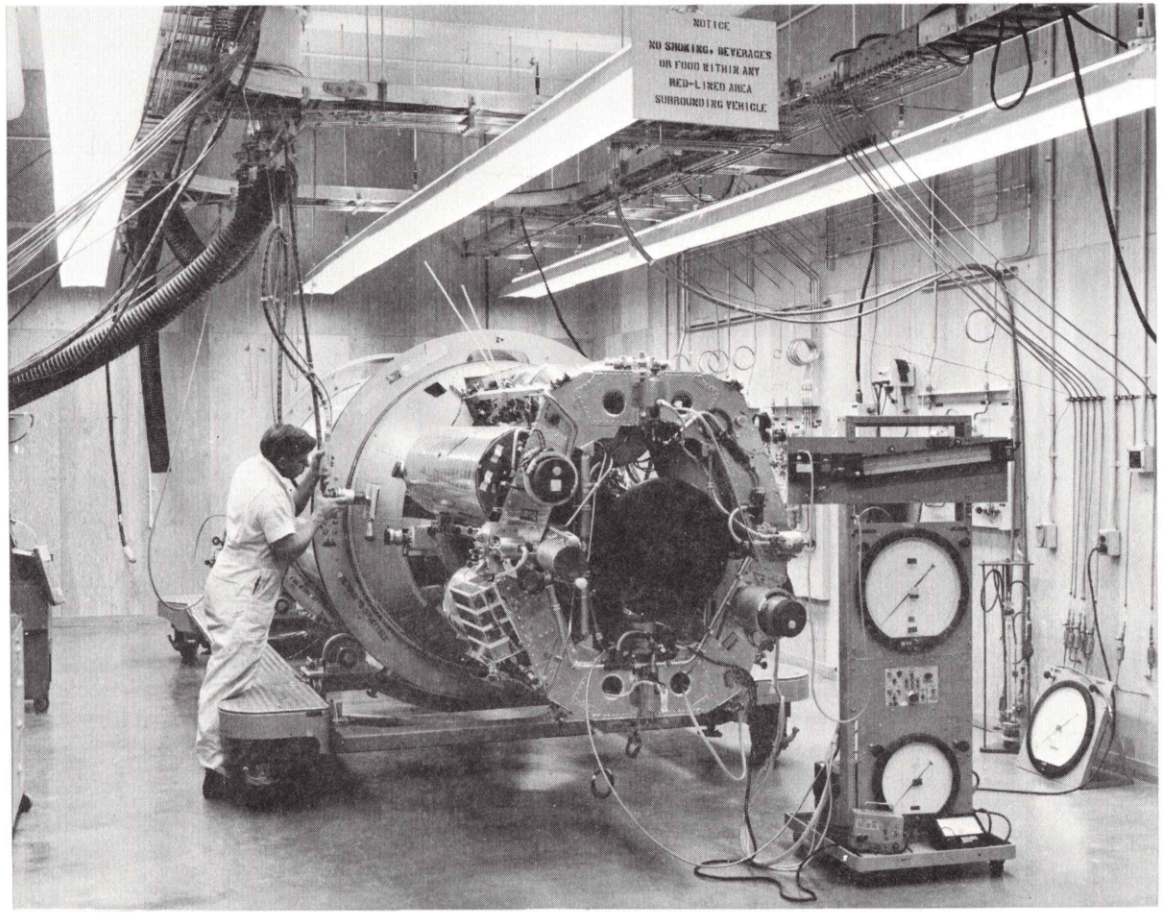
TEMPERATURE-ALTITUDE SIMULATION CHAMBER



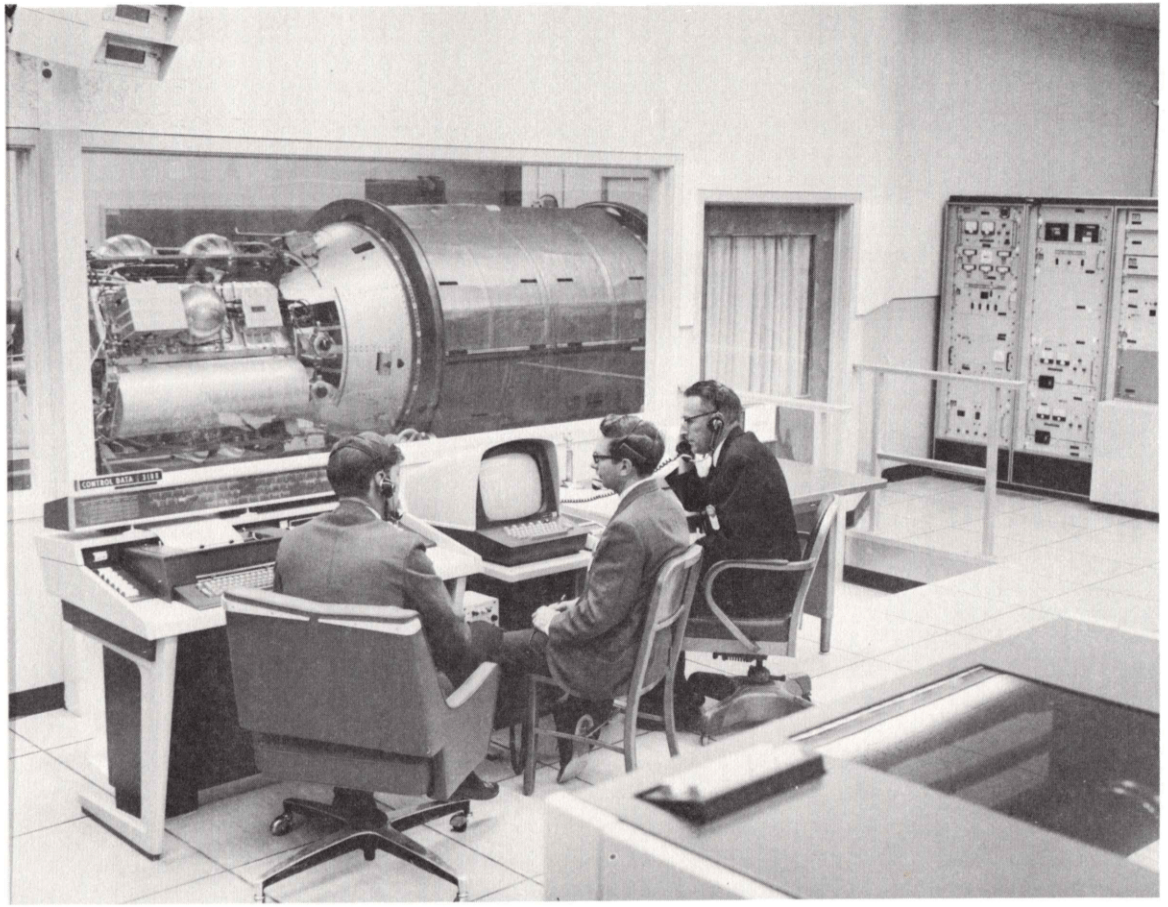
ENVIRONMENTAL TEST CHAMBER



HIGH PRESSURE TEST CELL

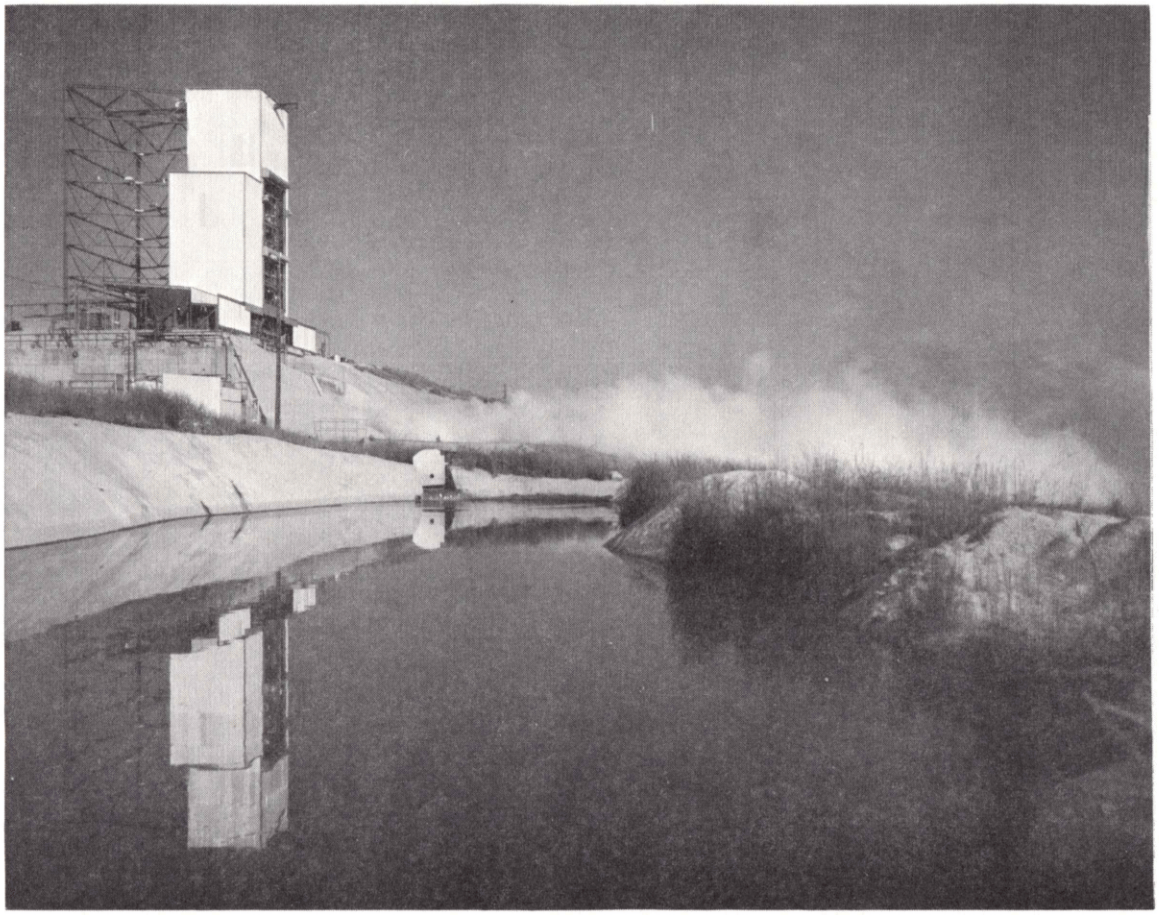


C-14 DATA AREA

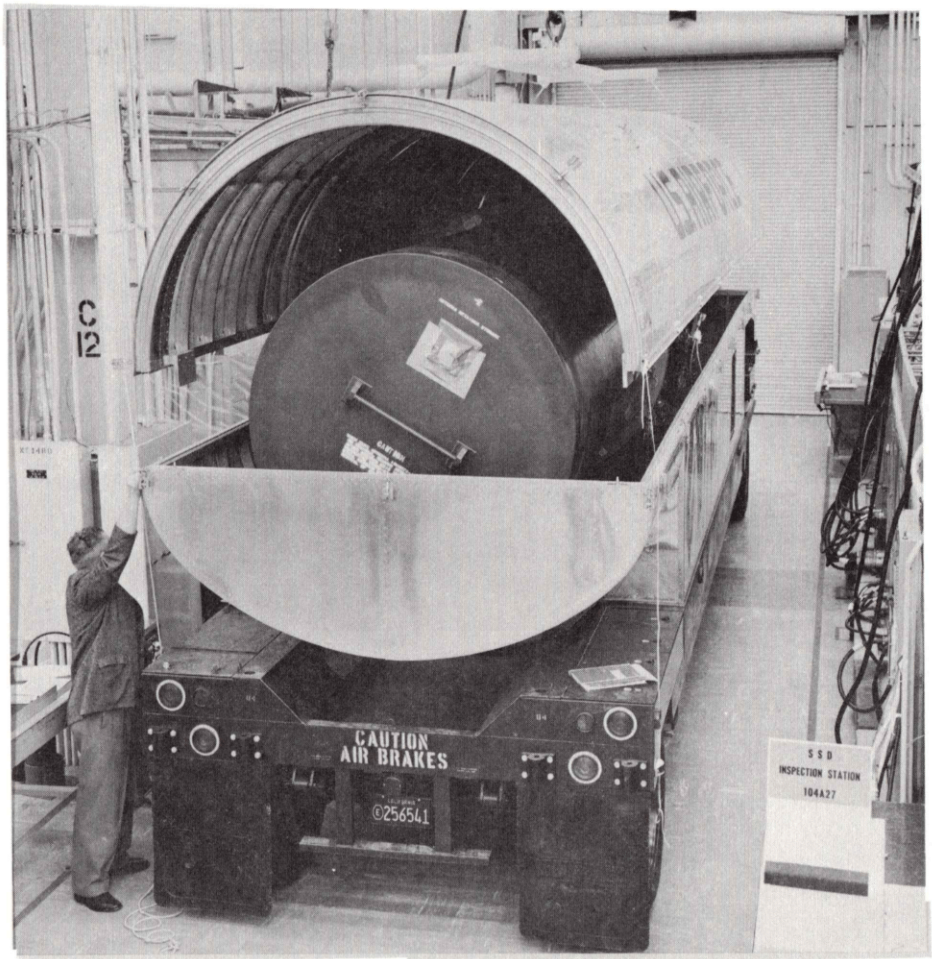


SANTA CRUZ TEST BASE

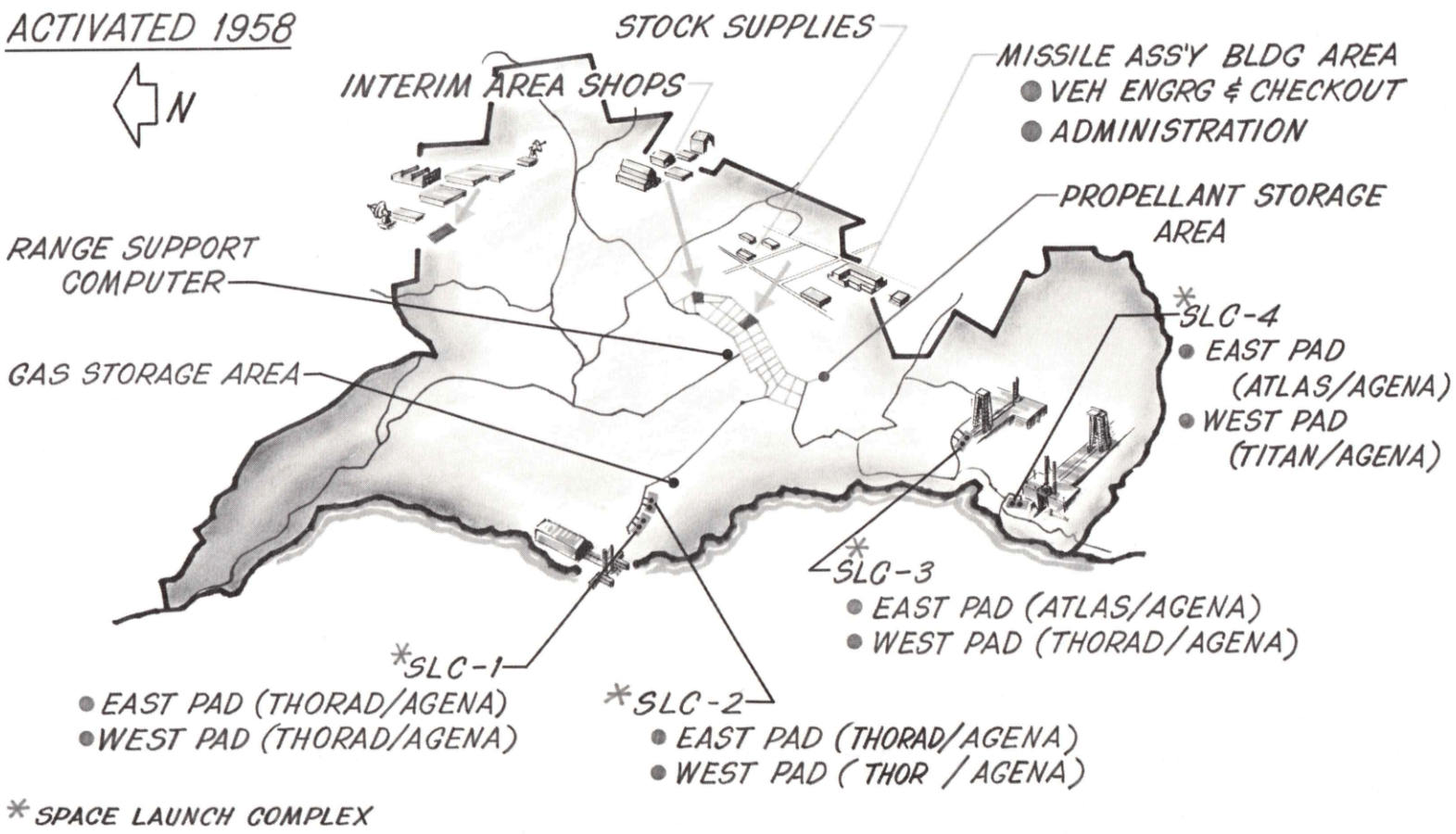
VEHICLE HOT FIRING



VEHICLE TRANSPORTER

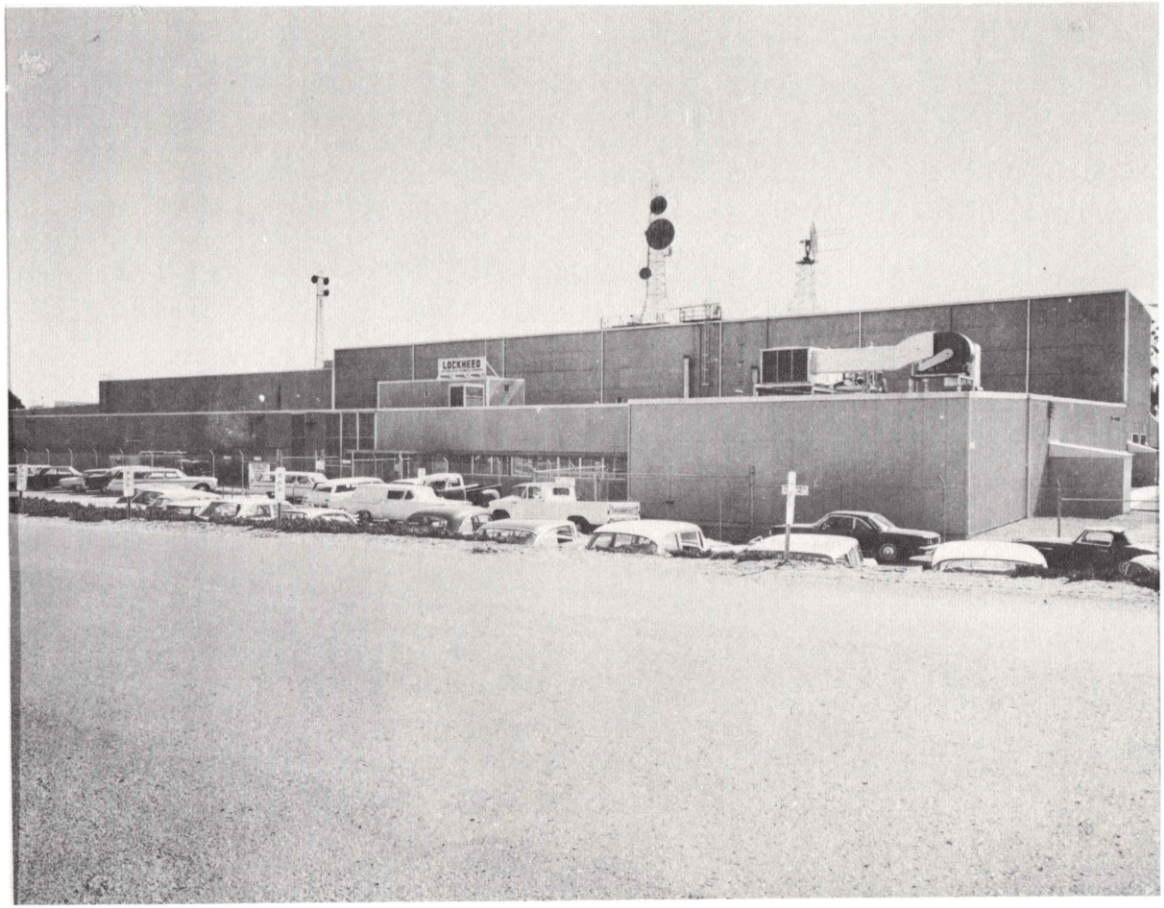


WESTERN TEST RANGE (VAFB)

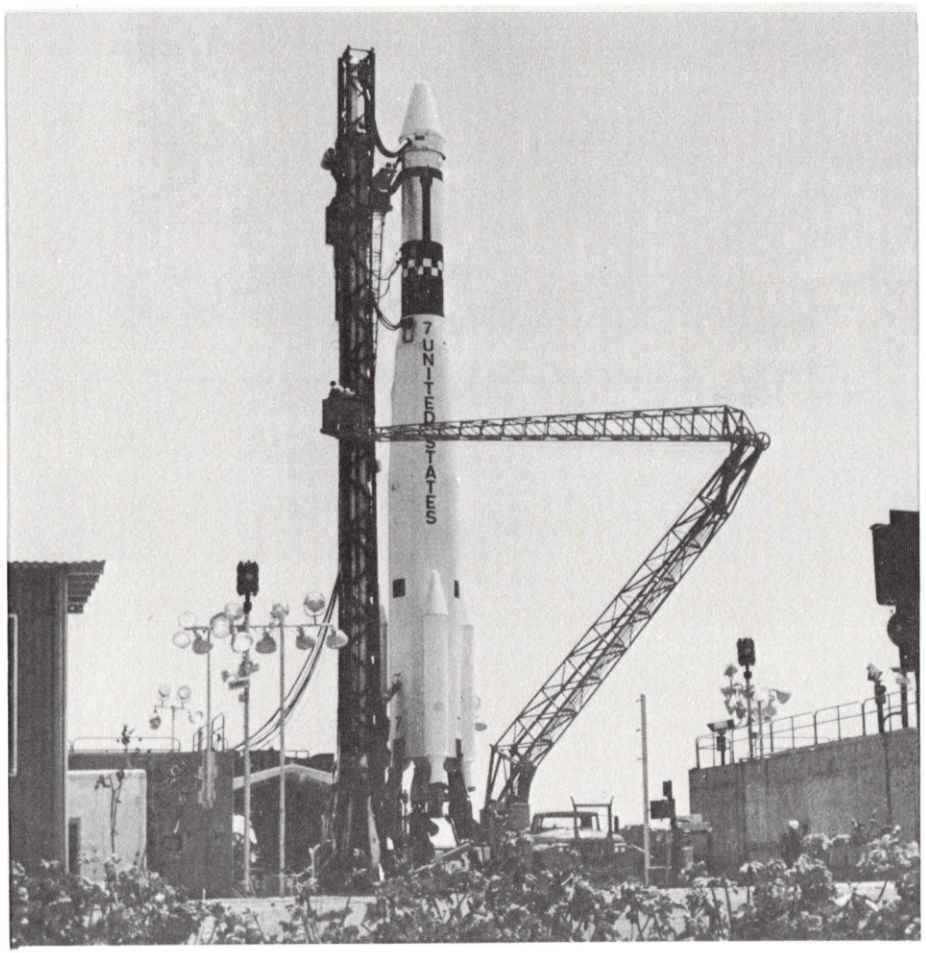


* SPACE LAUNCH COMPLEX

BUILDING 8310 - VAFB



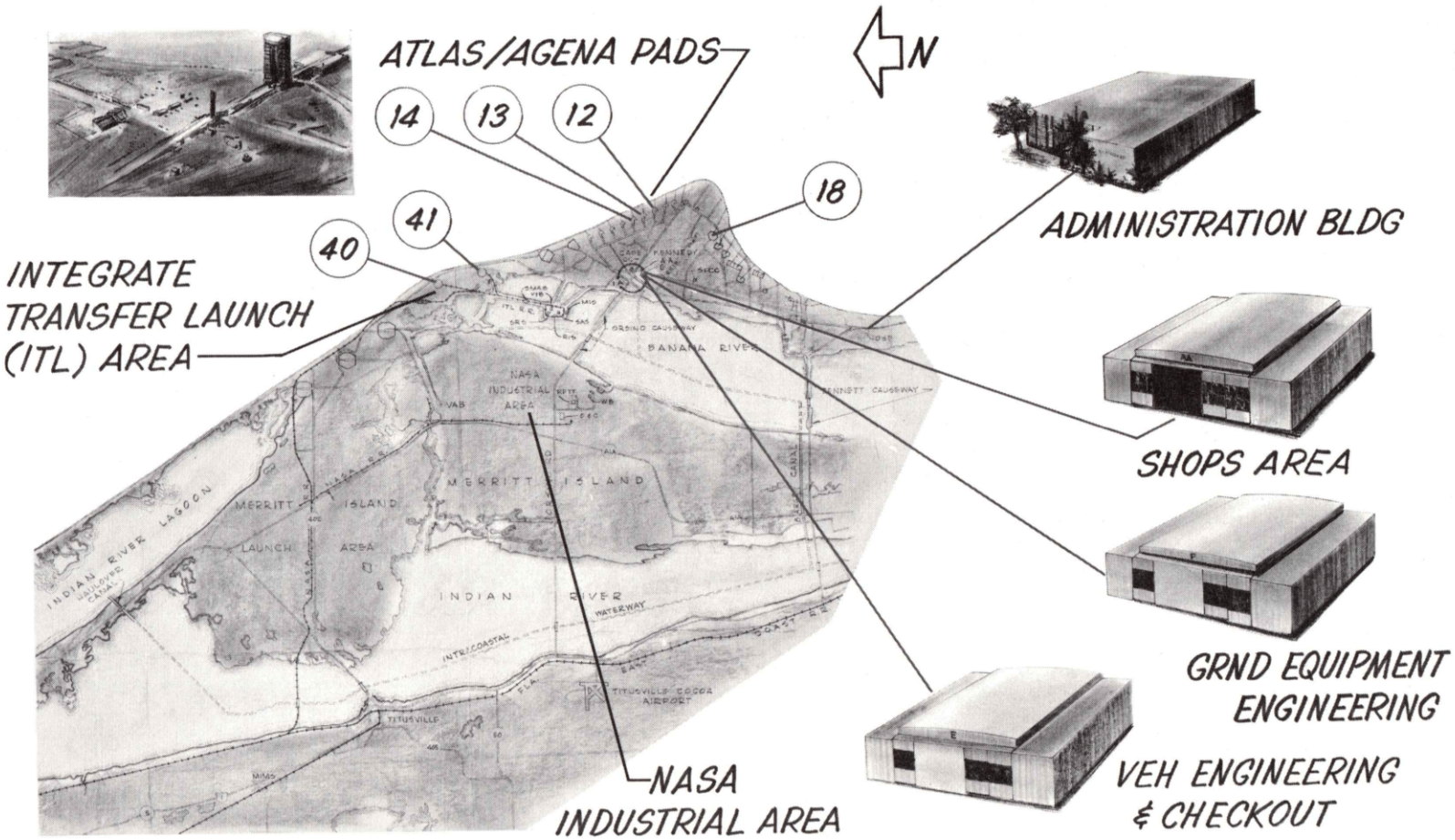
TAT/AGENA



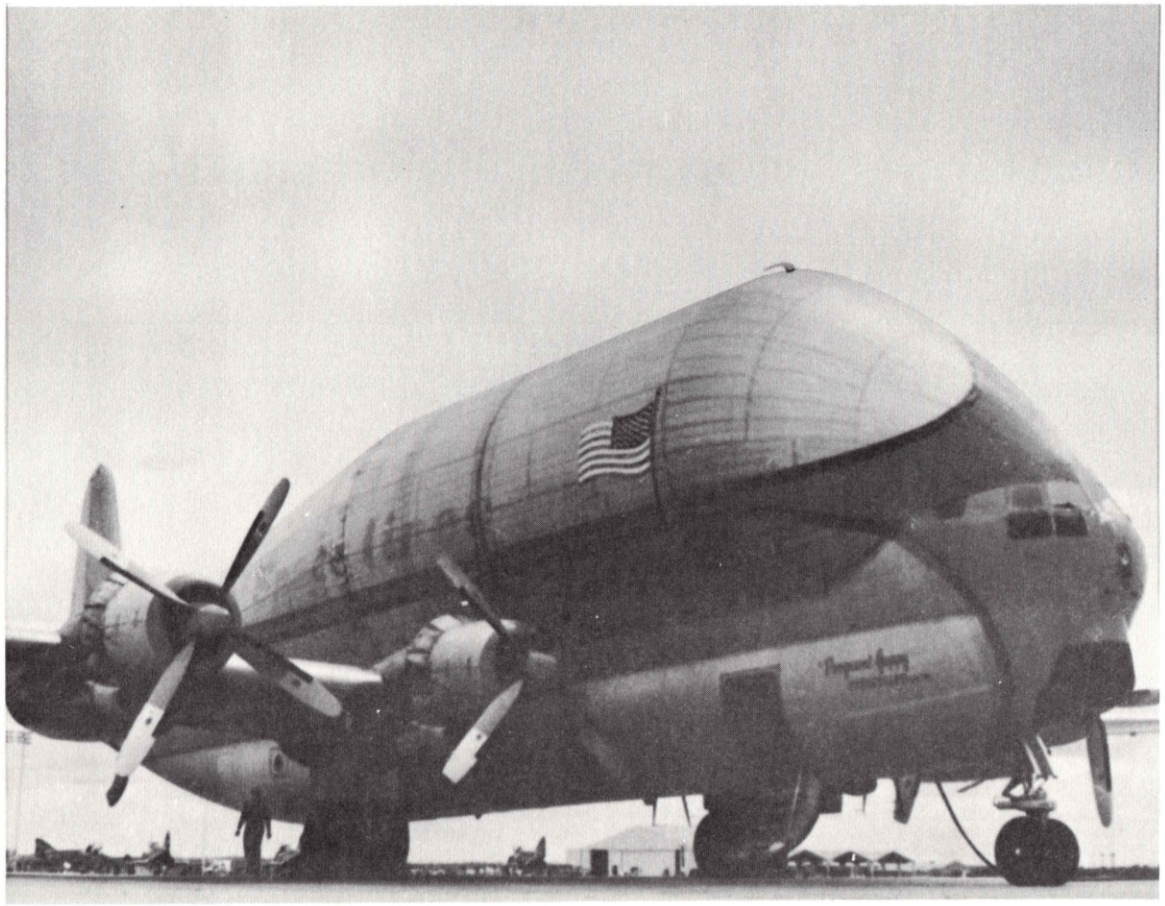
ATLAS/AGENA



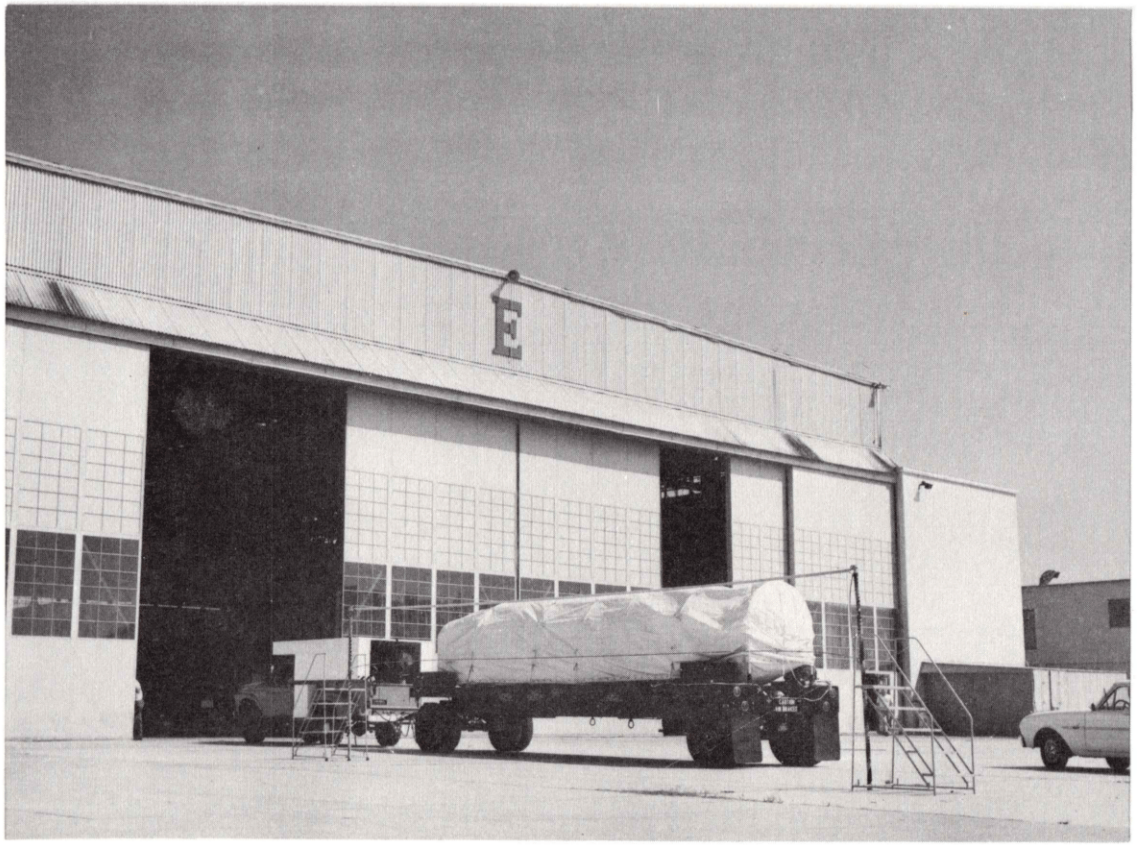
EASTERN TEST RANGE



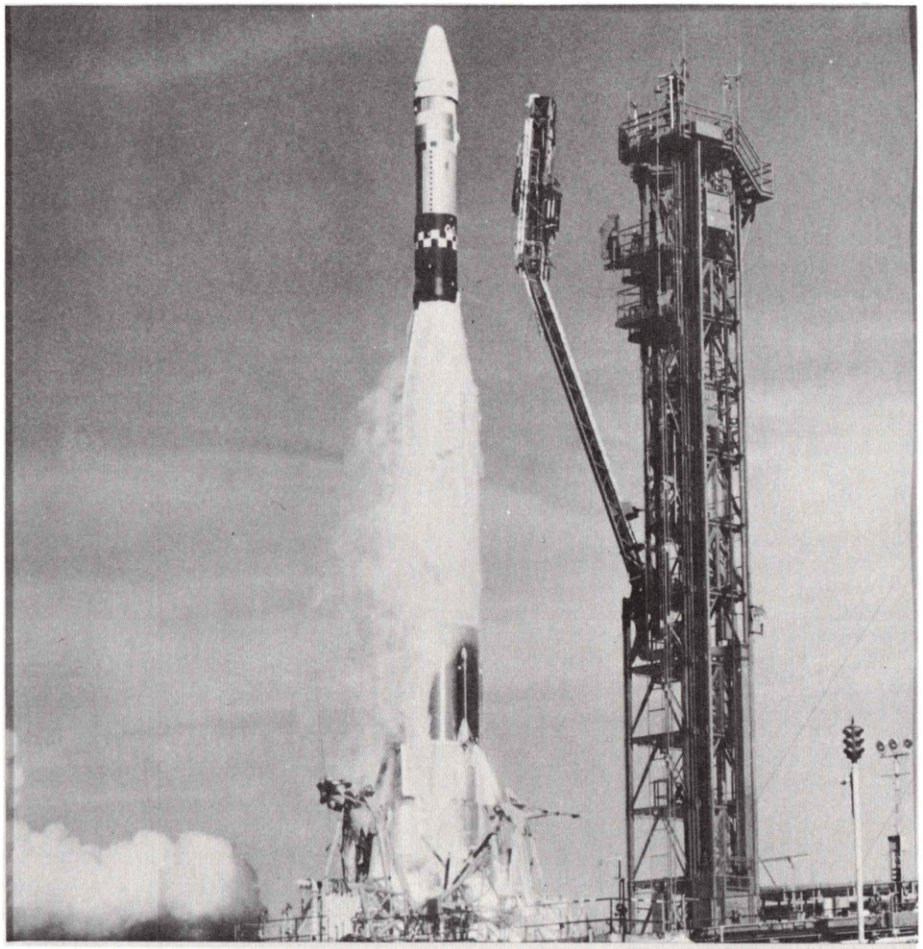
THE GUPPY



VEHICLE ENTERING HANGAR E

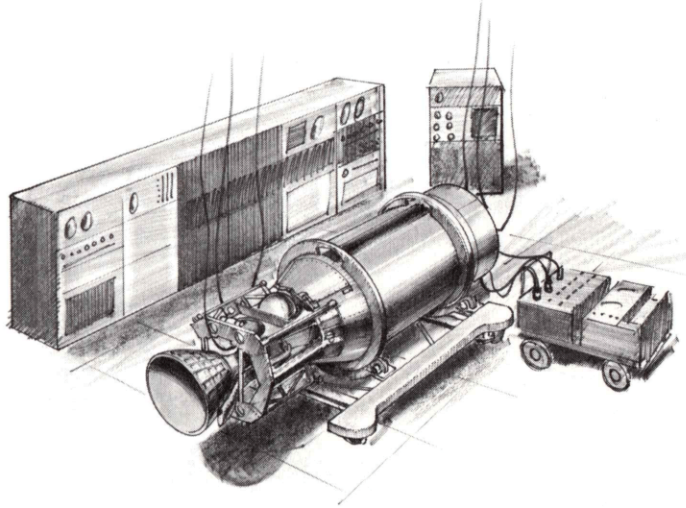


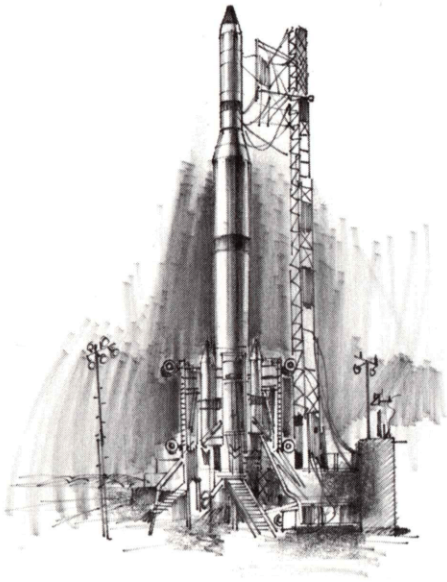
ATLAS/AGENA - LIFTOFF



SUPPORT SERVICES

TEST AND LAUNCH ACTIVITY

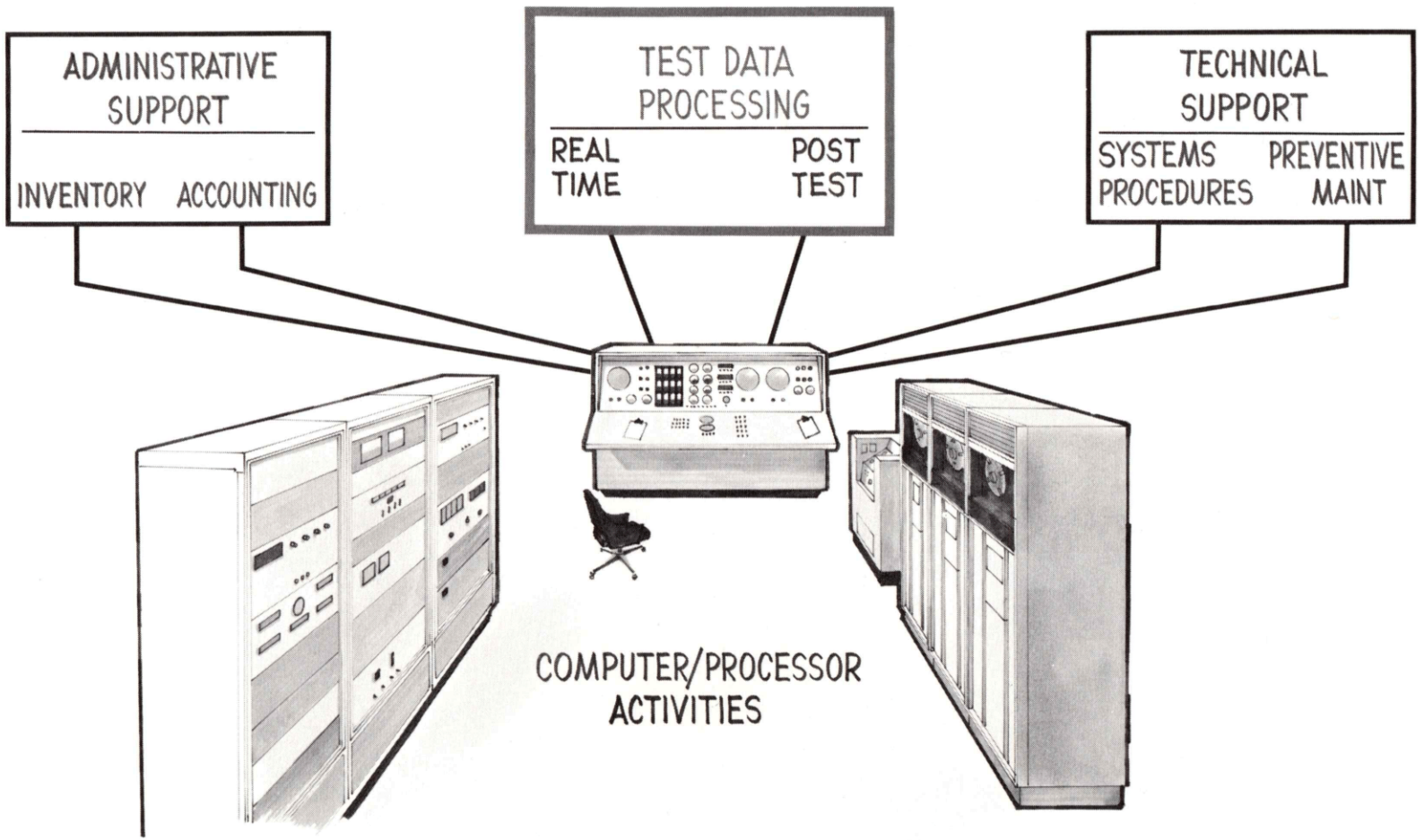




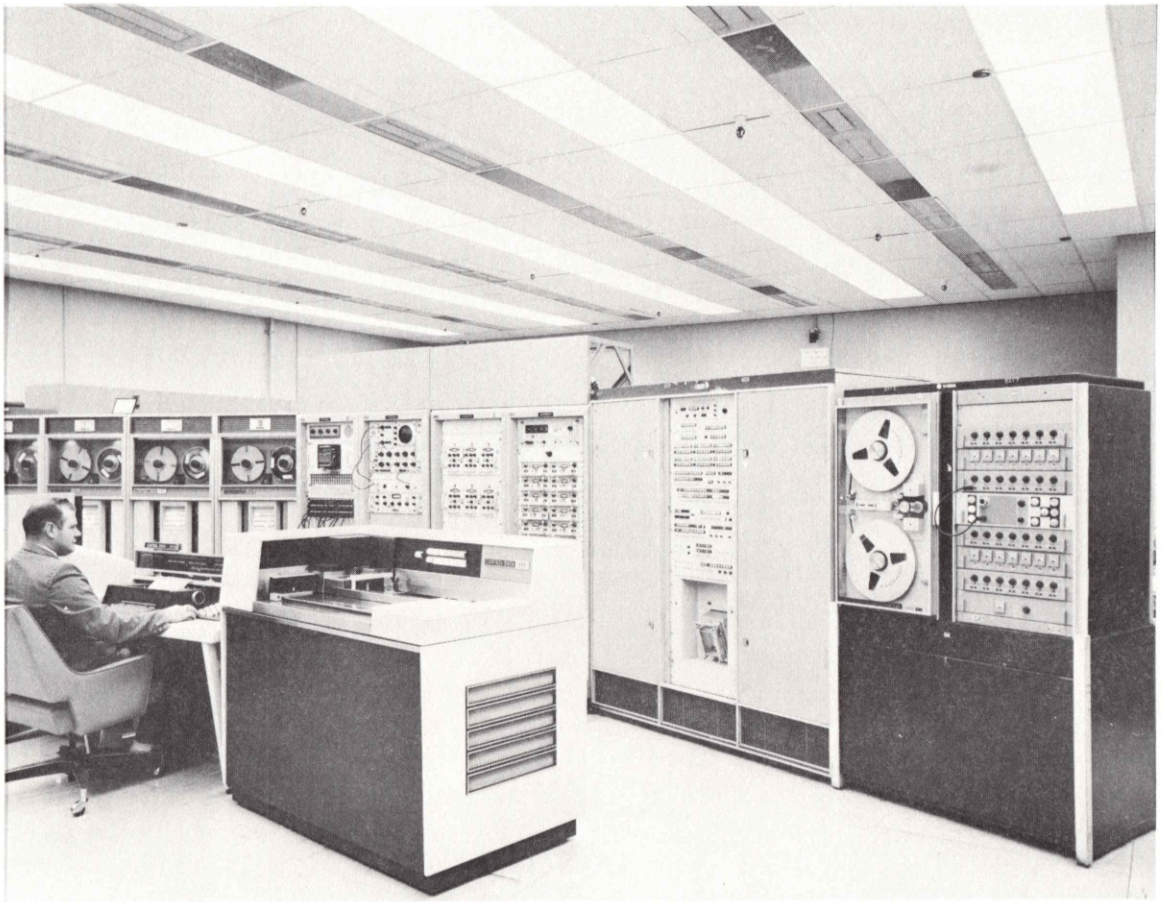
SUPPORT ACTIVITY

- DOCUMENTATION
- GROUND EQUIPMENT
- TECHNICAL SERVICES
- PROPERTY CONTROL
- TRAINING AND SAFETY
- MAINTENANCE & CALIBRATION

COMPUTER UTILIZATION



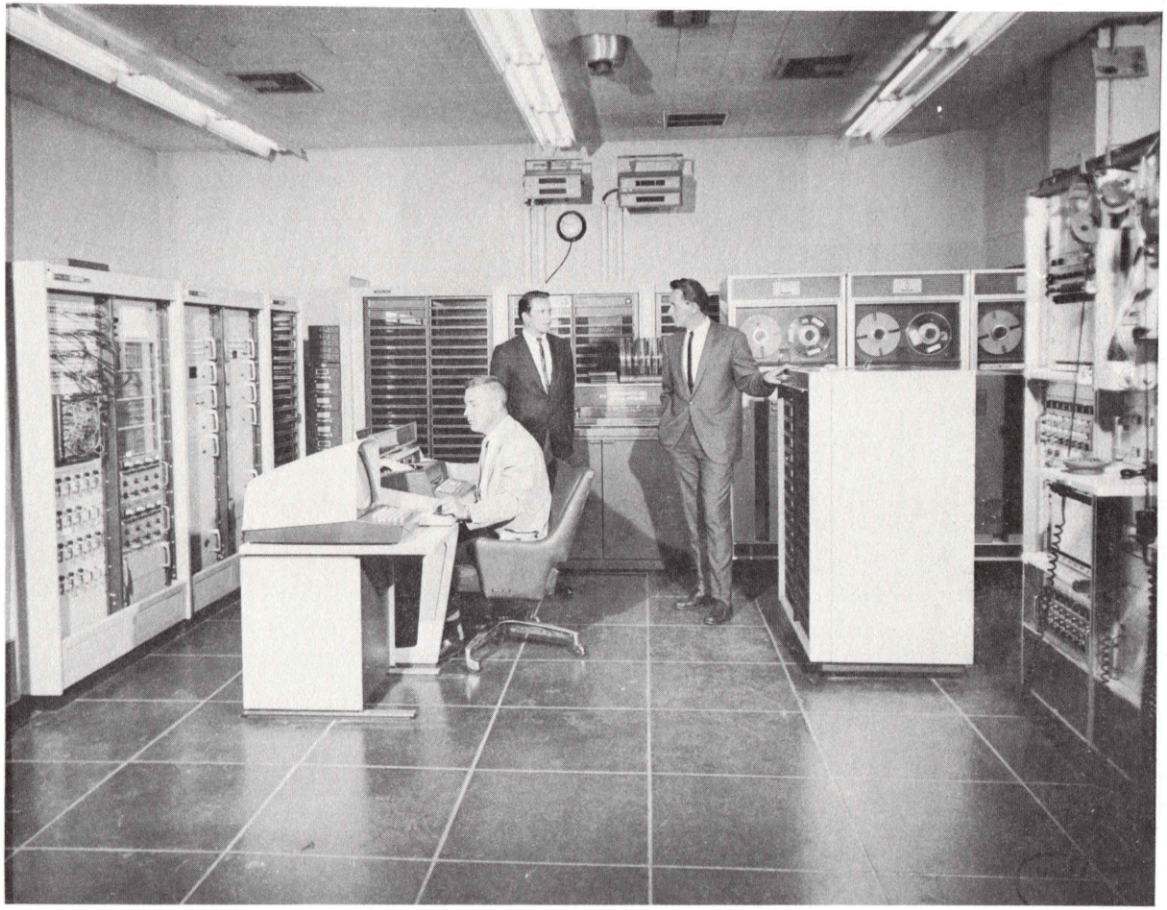
DATA REDUCTION AND PROCESSING EQUIPMENT



VANDENBERG AUTOMATIC DATA EQUIPMENT

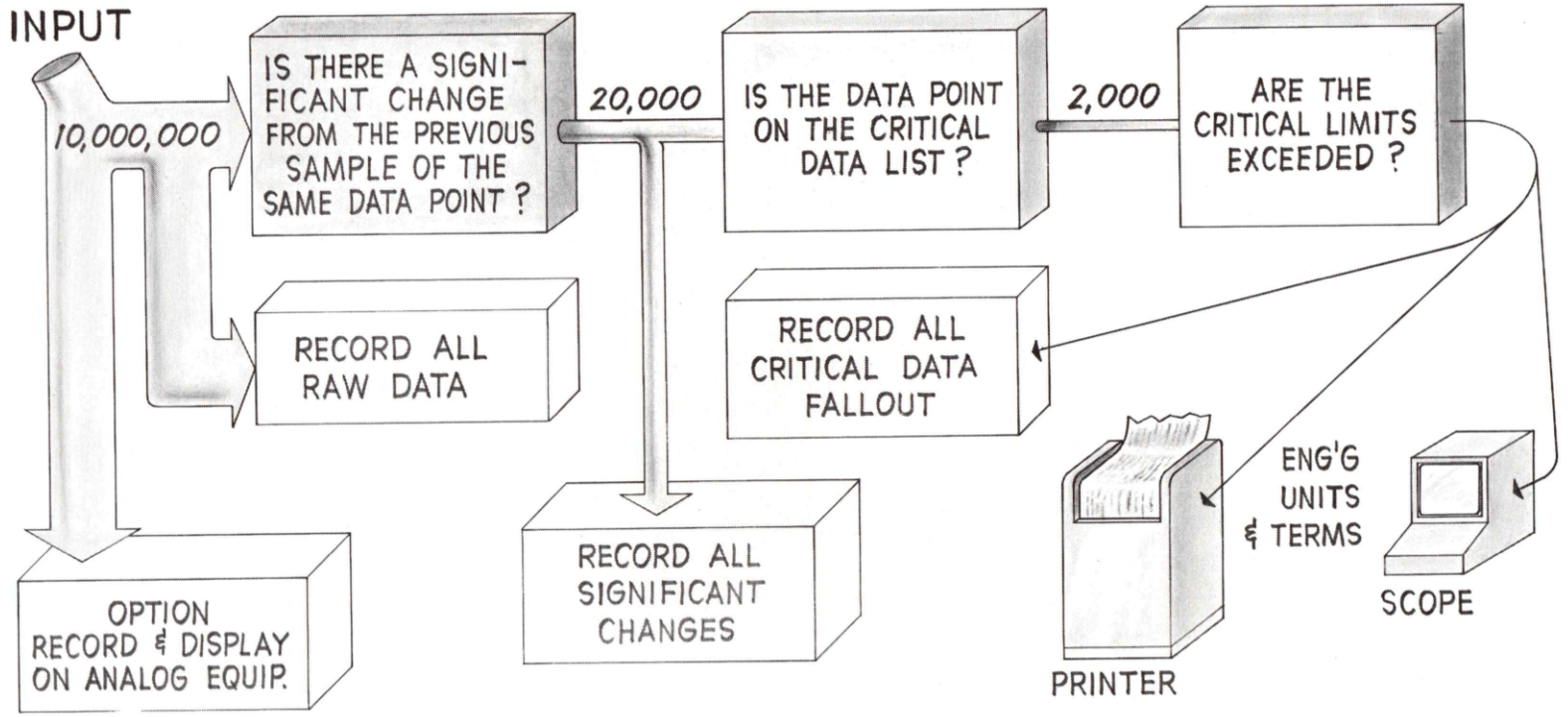


PAD AUTOMATIC DATA EQUIPMENT

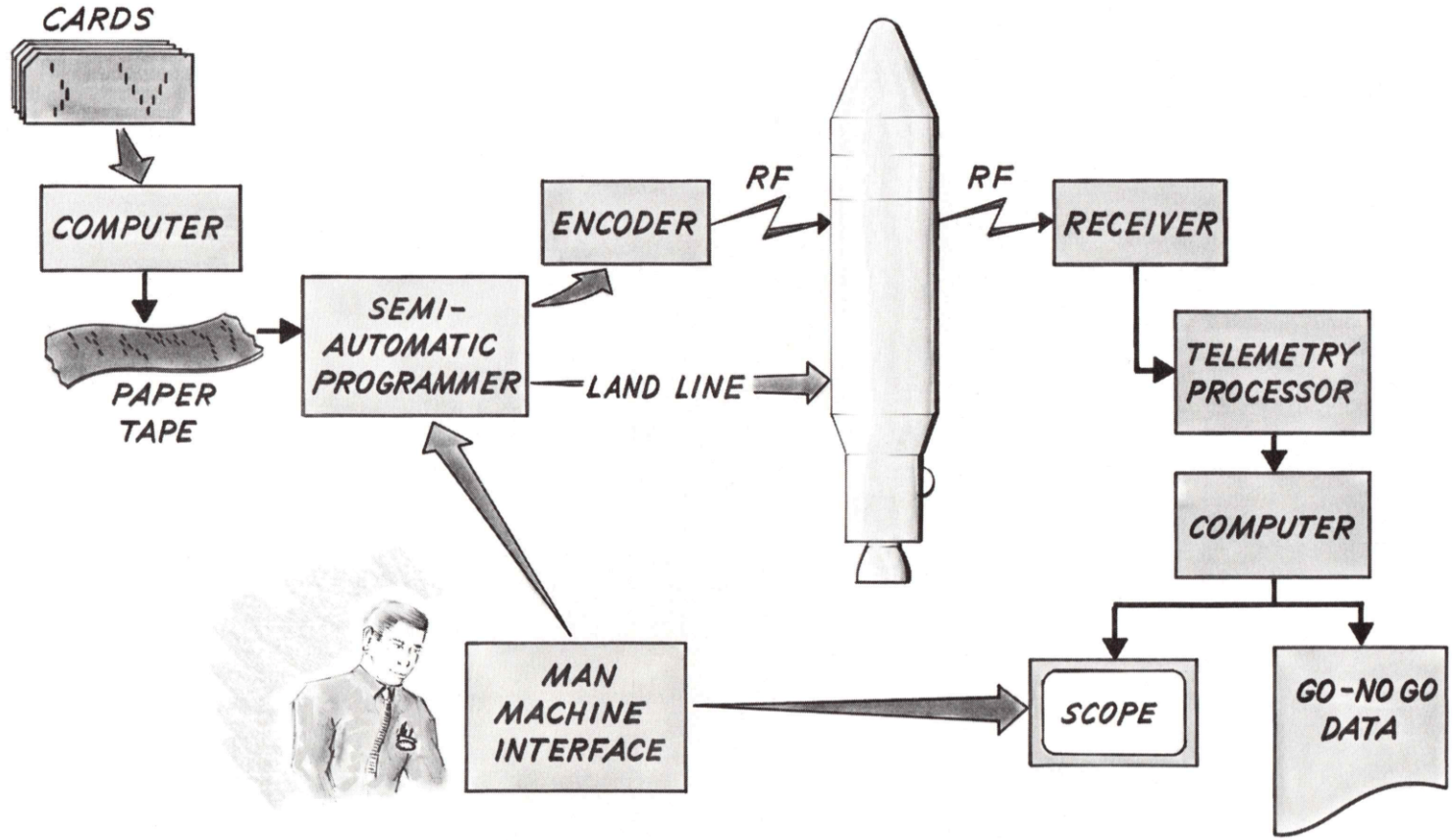


DATA COMPRESSION

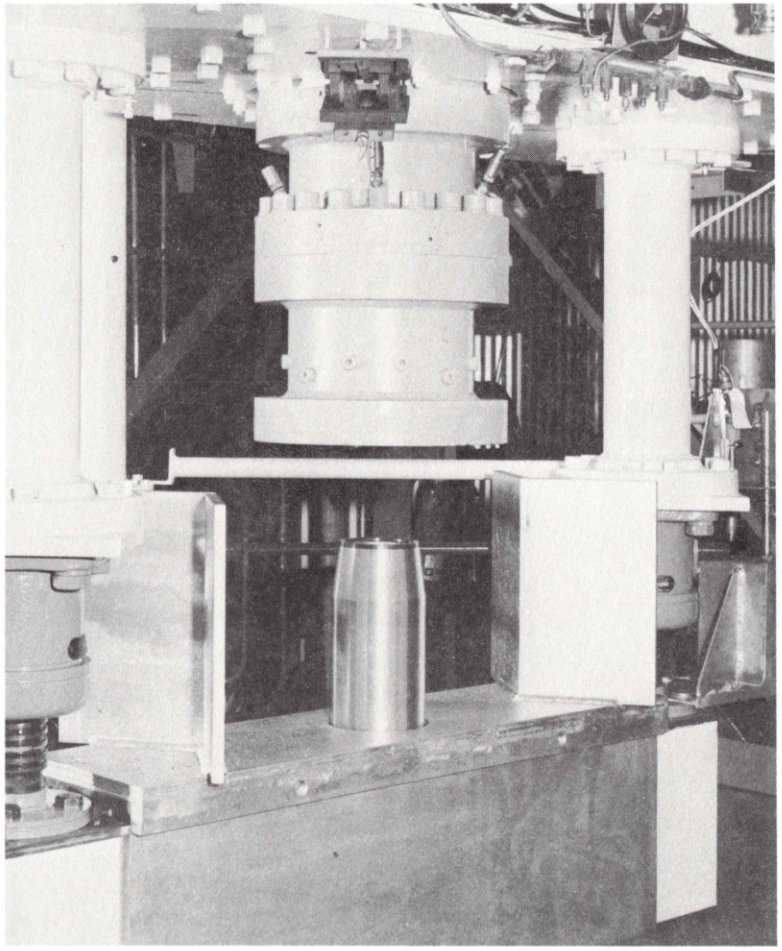
- COMPUTER EVALUATES ALL DATA
- PERSONNEL EVALUATE SIGNIFICANT DATA ONLY



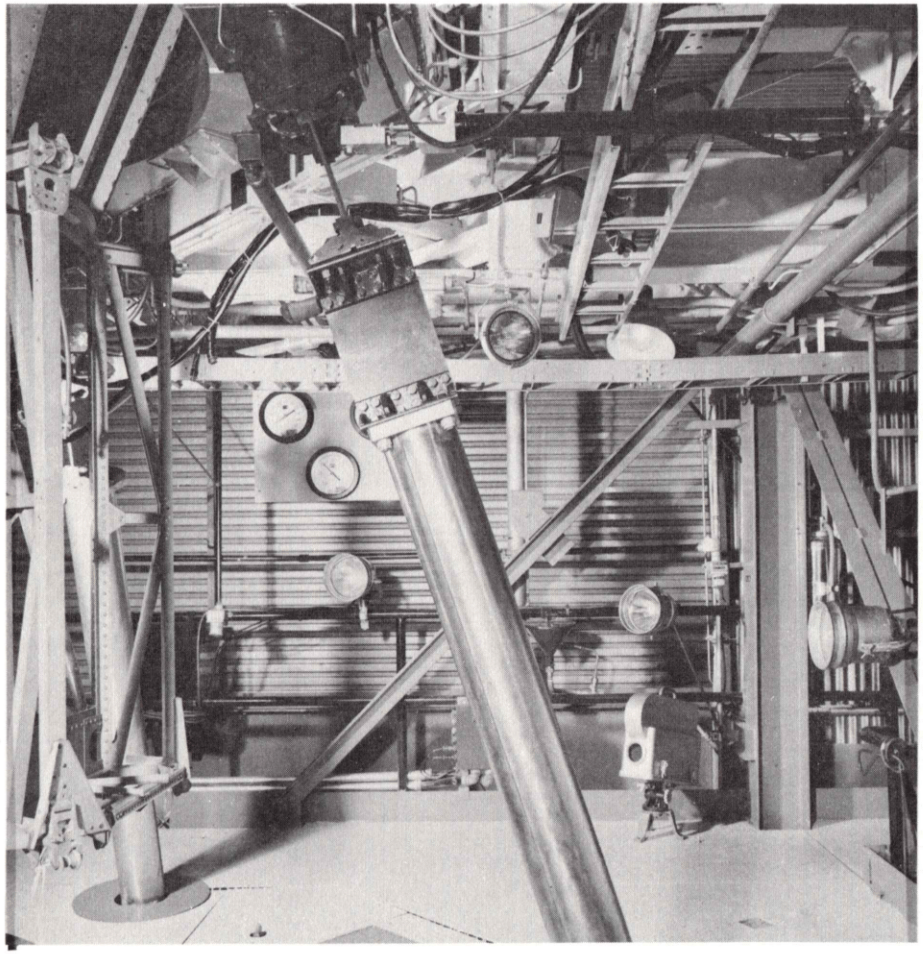
SYSTEMS AUTOMATIC CHECKOUT



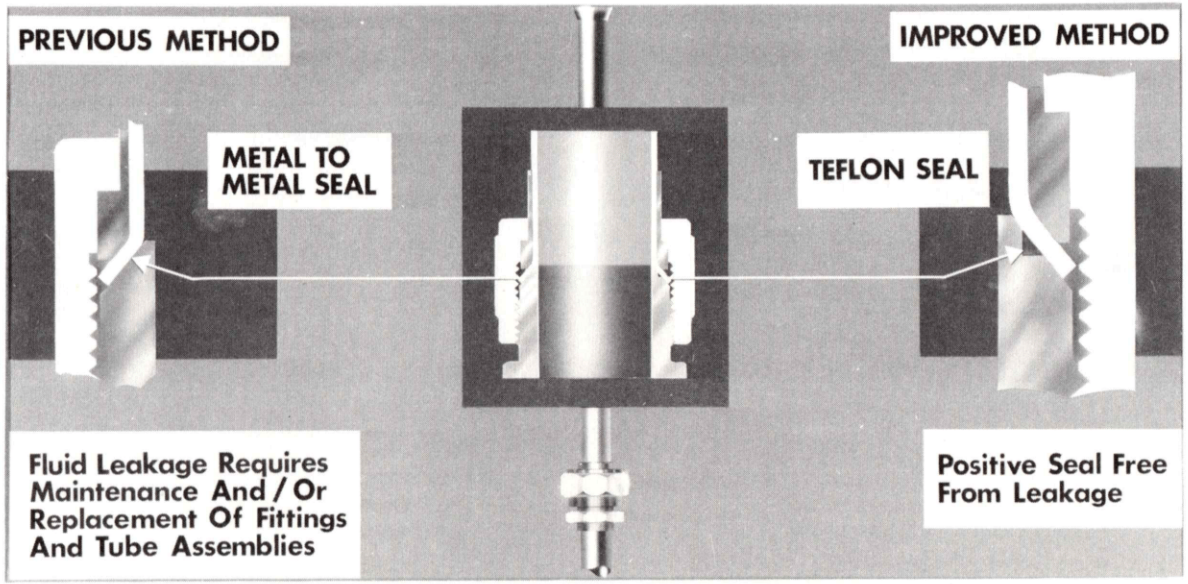
REENTRY TESTING



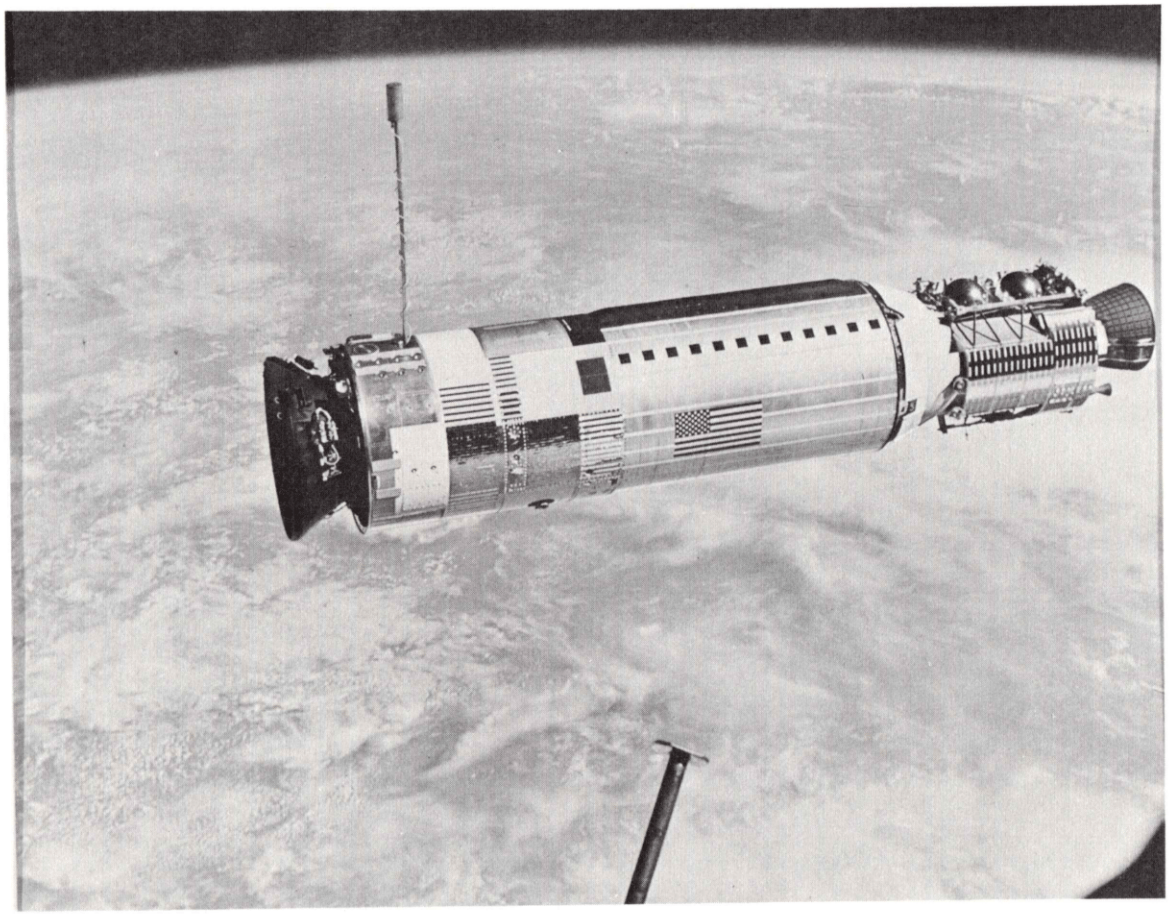
DYNA MOUNT



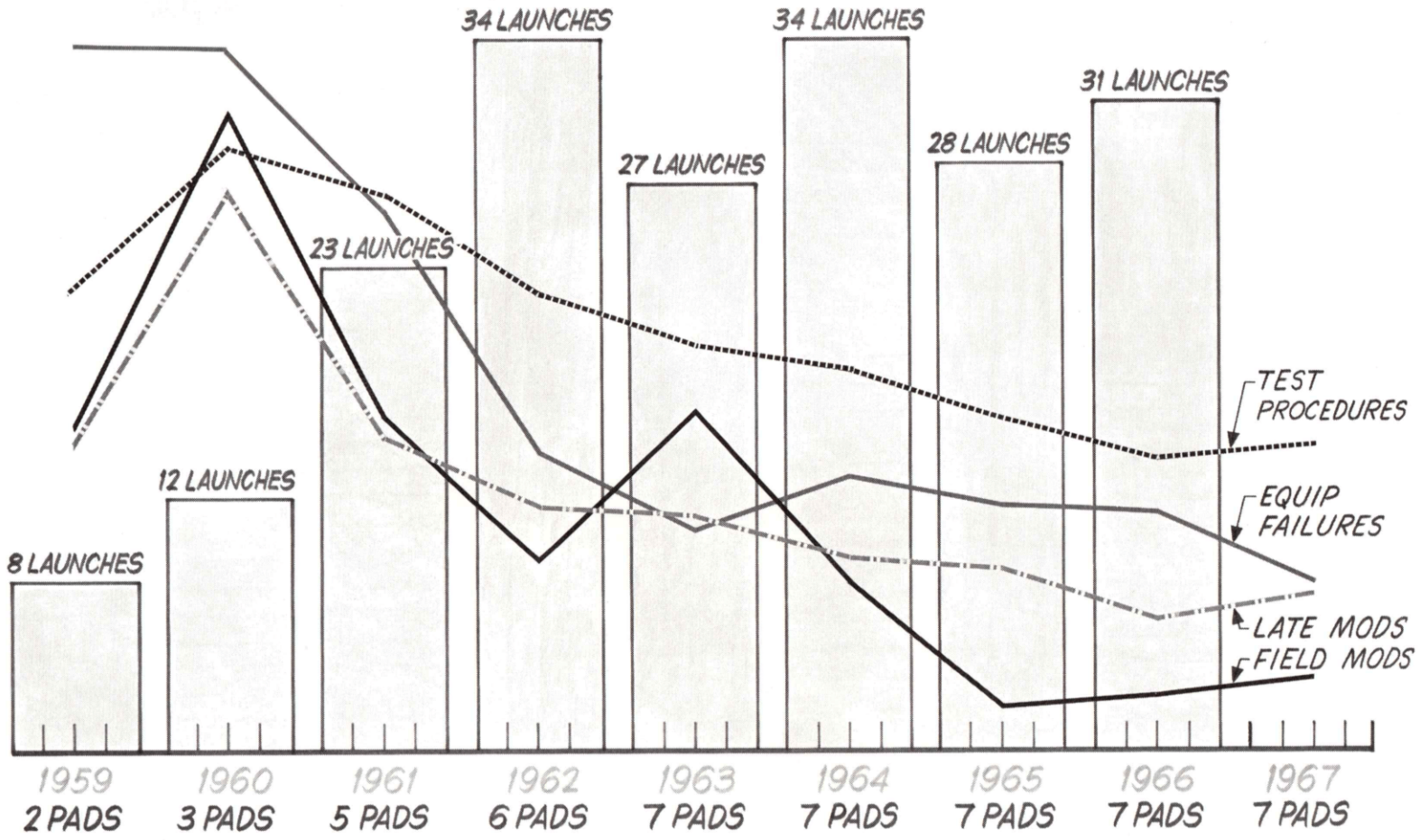
TEFLON SEAL IN HIGH PRESSURE FITTINGS



GEMINI / AGENA ON ORBIT



LAUNCH BASE HISTORICAL SUMMARY



LAUNCH PERFORMANCE

BEST: STORAGE TO LAUNCH - 45 DAYS

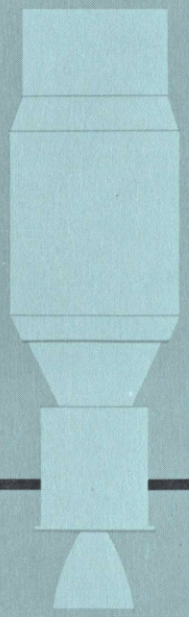
BEST: LAUNCH TO LAUNCH - 13 DAYS (SAME PAD)

BEST: RECEIPT TO LAUNCH - 10 DAYS

LAUNCH ON TIME PERFORMANCE 1966-1967

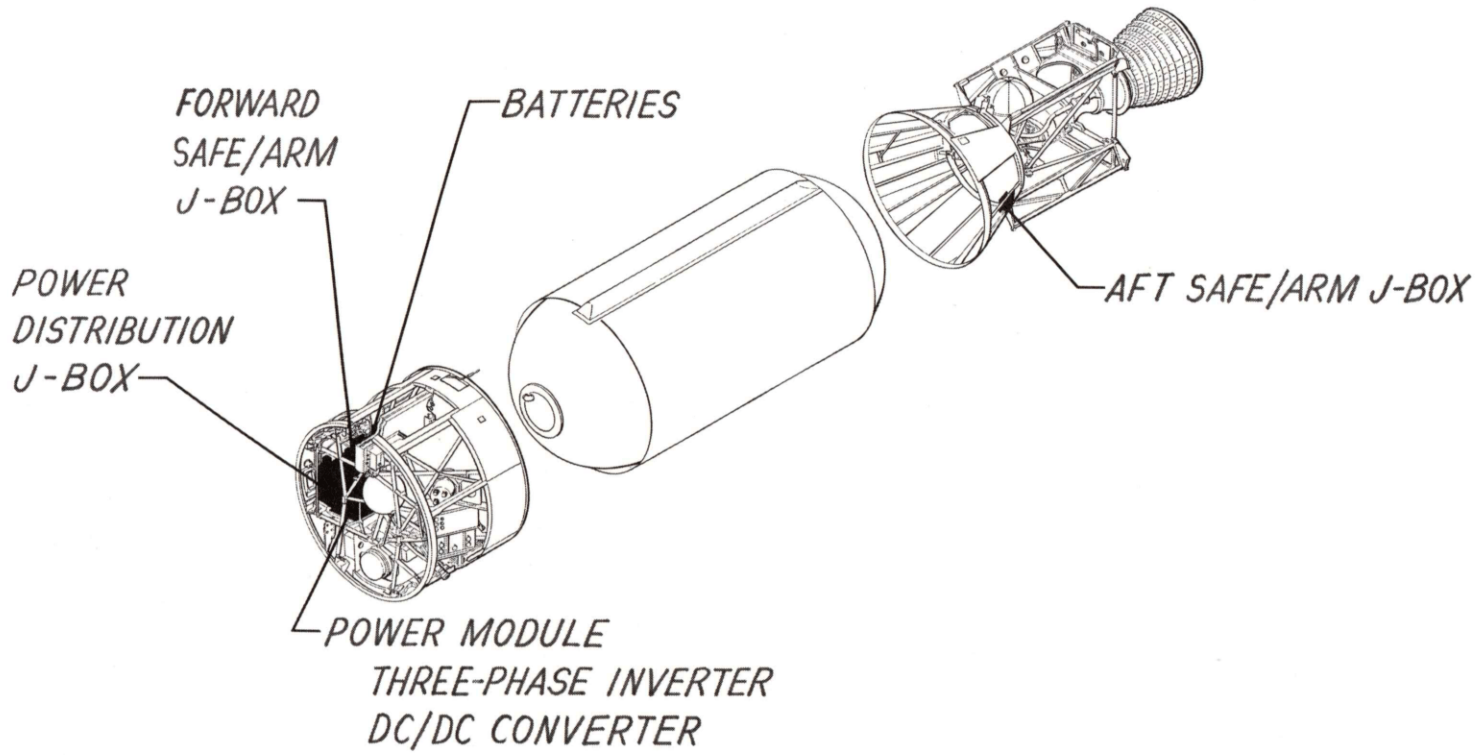
LAUNCH PERIOD DAYS USED				
1ST DAY	2ND DAY	3RD DAY	-----	11TH DAY
49	9	5		1

LAUNCH WINDOW MINUTES USED					
≤1	>1≤5	>5≤10	>10≤20	>20≤30	>30
23	5	2	14	10	10

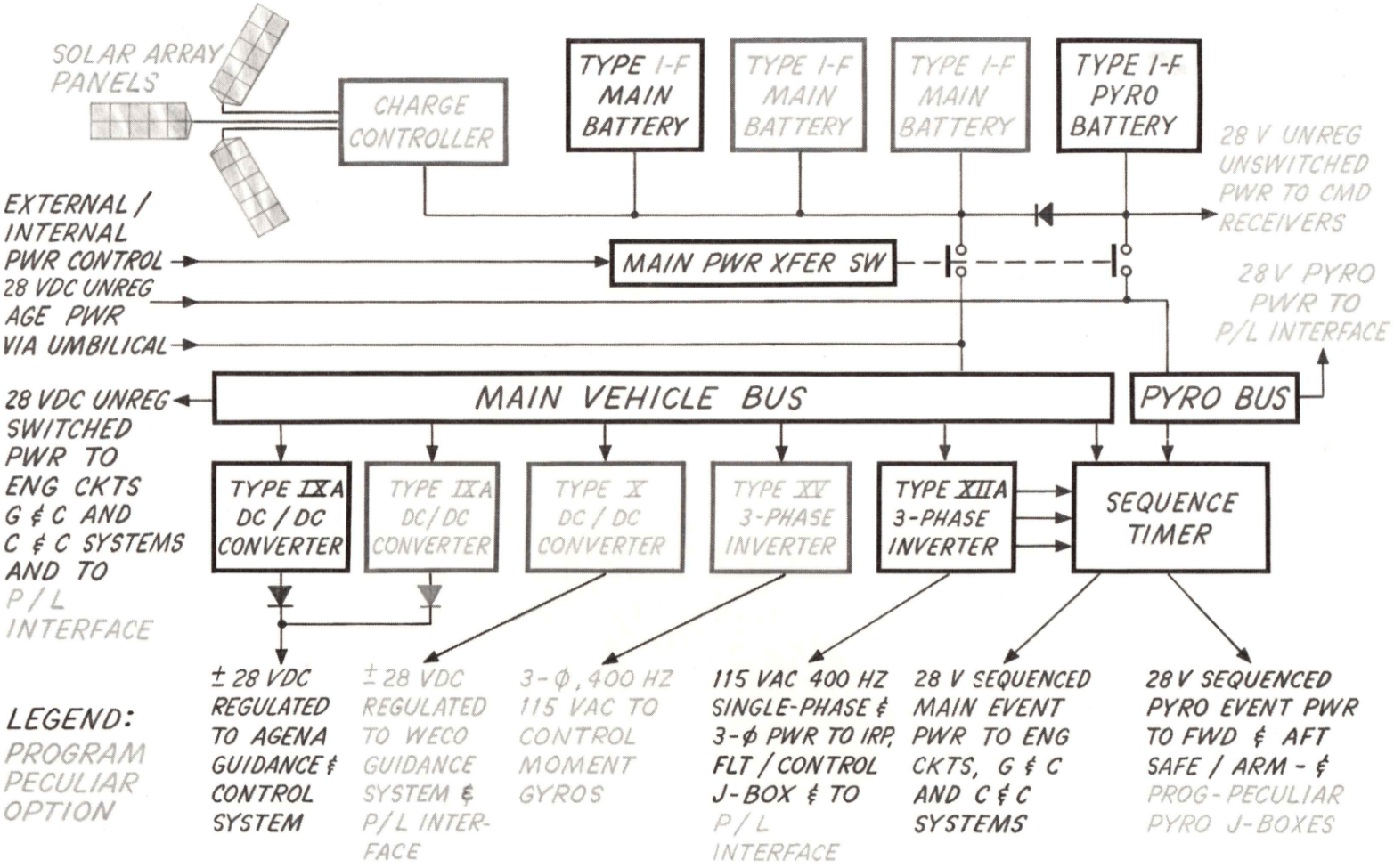


ELECTRICAL SYSTEM

ELECTRICAL


FORWARD
SAFE/ARM
J-BOX
BATTERIES
POWER
DISTRIBUTION
J-BOX
AFT SAFE/ARM J-BOX
POWER MODULE
THREE-PHASE INVERTER
DC/DC CONVERTER

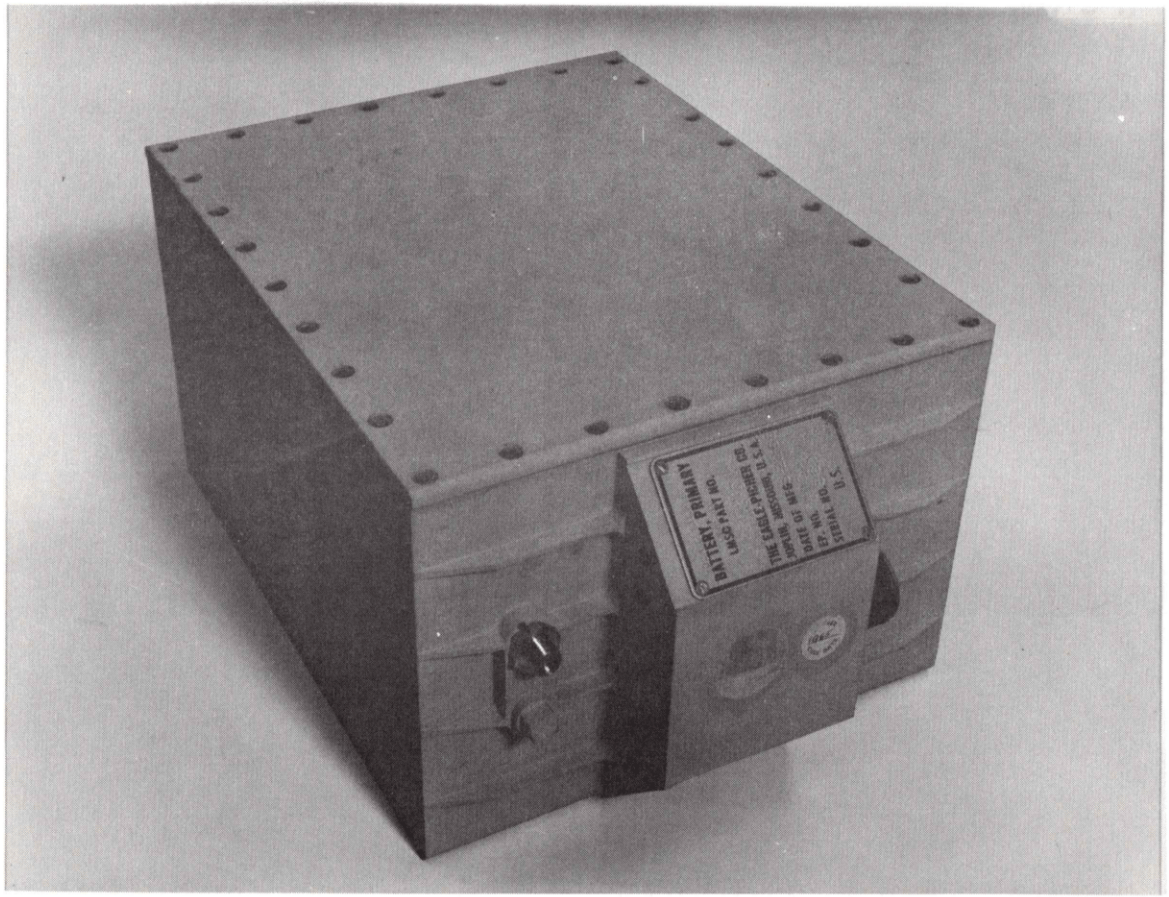
POWER DISTRIBUTION SYSTEM



TYPICAL FLIGHT BATTERIES

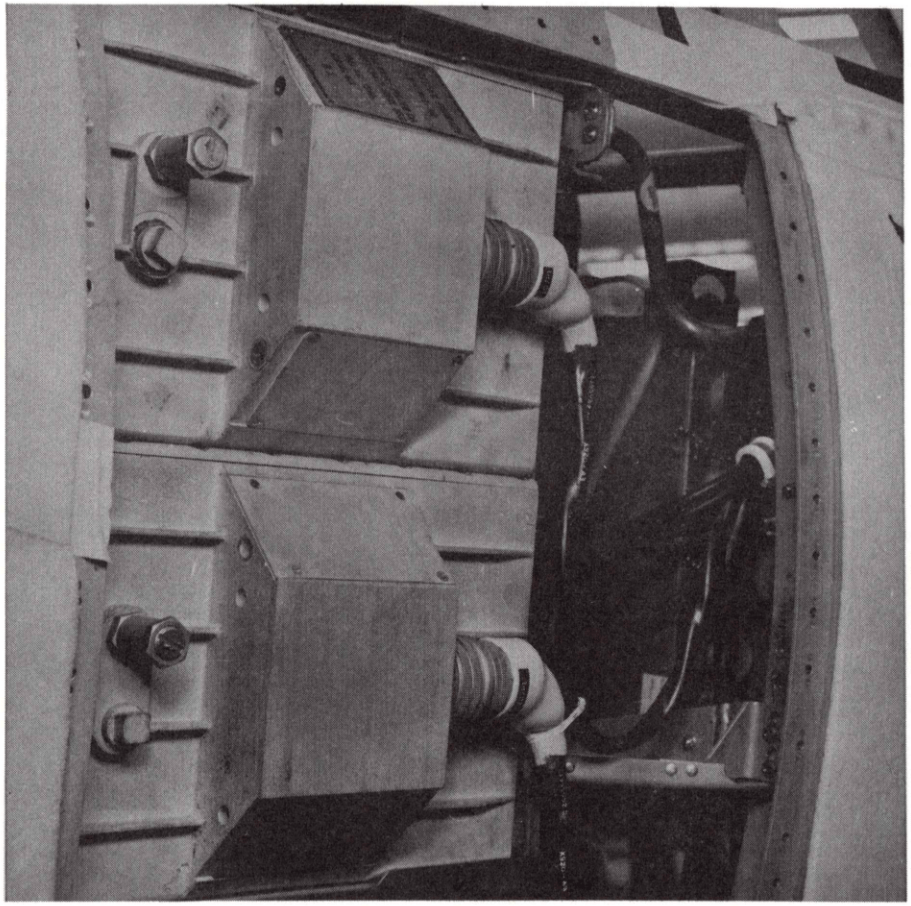
TYPE		APPLICATION REMARKS	NO. OF CELLS	NOM LOADED VOLTS	WET STAND LIFE (DAYS)	AMP HOURS	WATT HOURS (MEAN)	WT (LBS)	WATT-HOURS PER LB
I-C	AgZn	LOW DISCHARGE RATE SERVICE	16	25	30	450	11,800	118	100
I-F, H, K	AgZn	LOW DISCHARGE RATE SERVICE	16	25	90	500	12500	128	101
IV-B	AgZn	HIGH DISCHARGE RATE SERVICE	18	28	30	16	448	17	26
VI	AgZn	LOW DISCHARGE RATE SERVICE	17	26.5	30	70	1980	27	73
XXIV	AgZn	SURGE LOADS	16	25	30	44	1100	21	52
XXVII	AgZn	SIMILAR TO IV B	17	26.5	30	16	425	16	27
					MOS				
V	NiCd	COMMAND DESTRUCT UNIT	24	29	24	.5	14	3	4
VI-A	NiCd	SELF DESTRUCT UNIT SAME CELL AS TYPE V	6	7.5	24	.18	1.33	1	1.4
XI	NiCd	SOLAR ARRAY-RECHARGED	20	23-29	30	18	500	62	8
XXV	AgZn	SPECIAL (PROGRAM-PECULIAR)	16	25	6	300	7500	116	65

TYPE I-C BATTERY



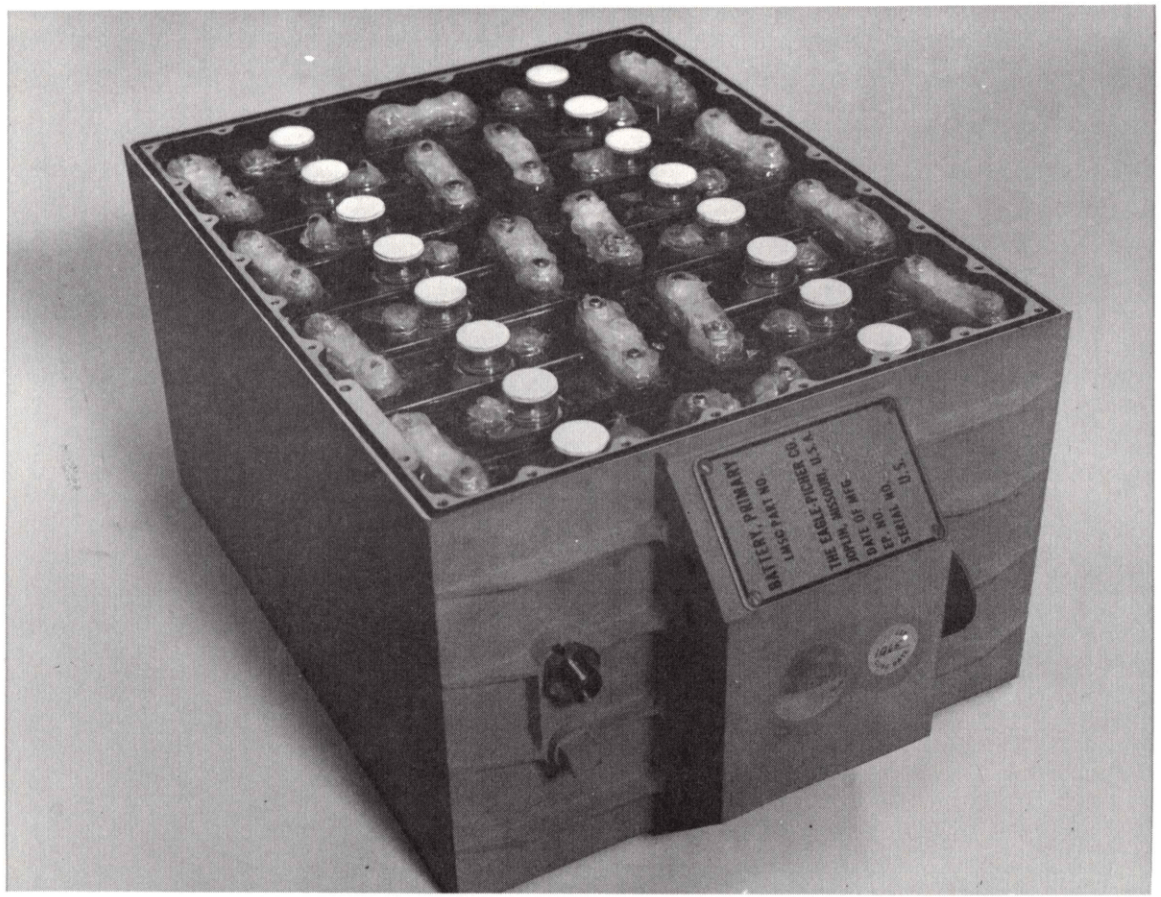
I-C BATTERIES

FORWARD RACK



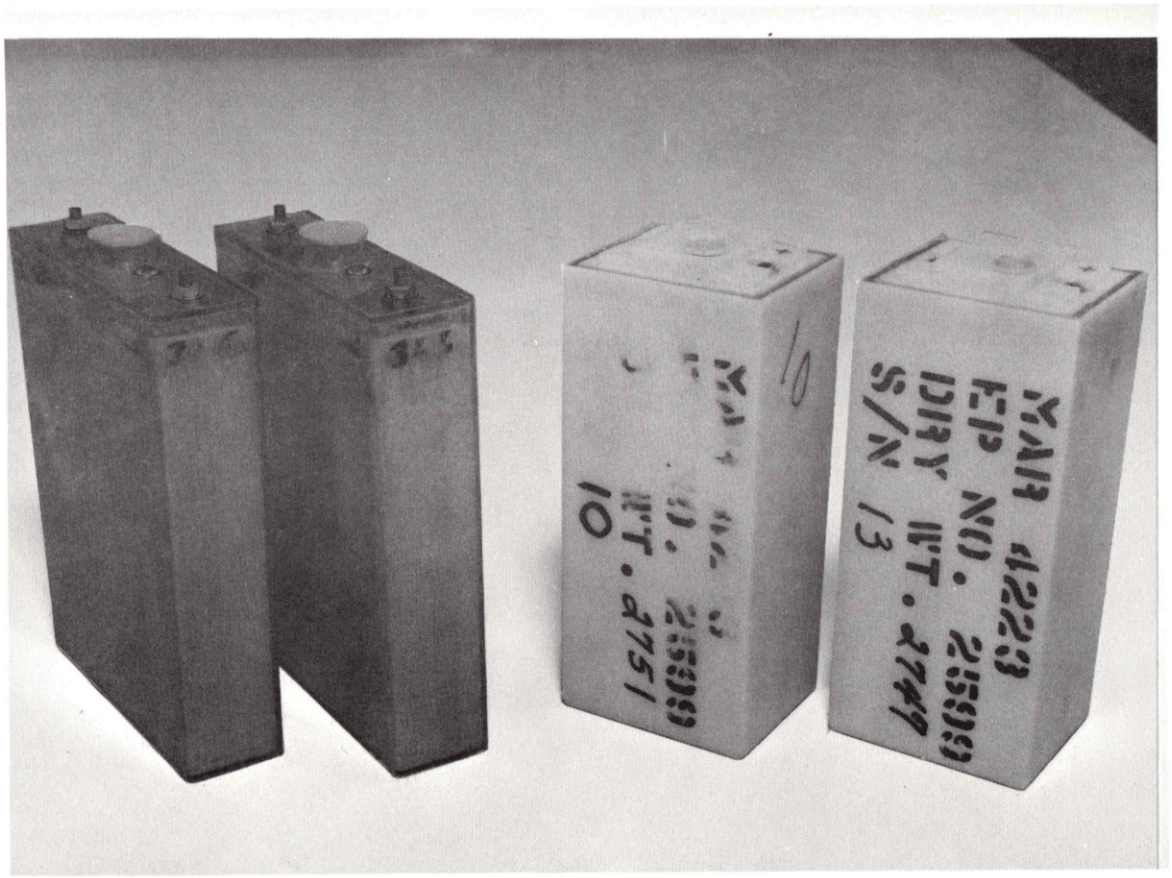
TYPE I-C BATTERY

COVER REMOVED



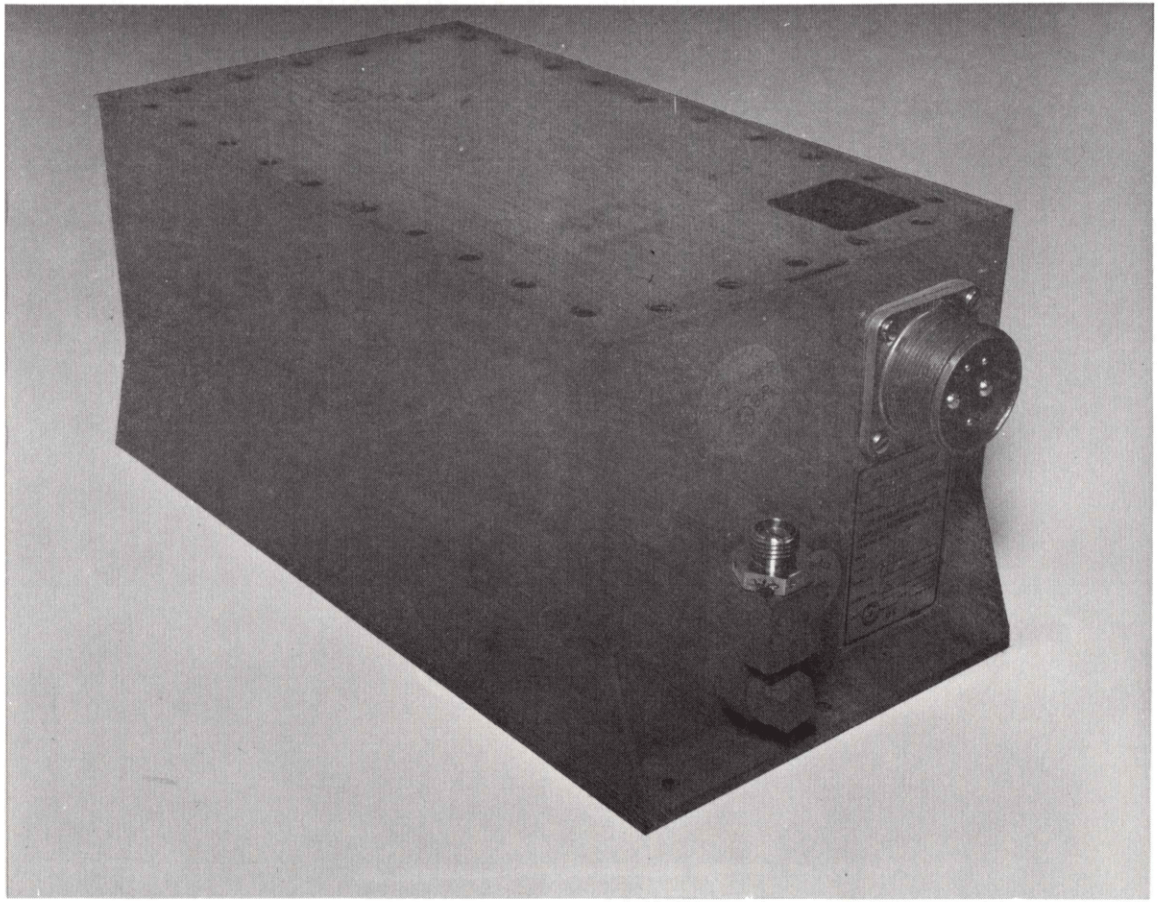
INDIVIDUAL BATTERY CELLS

I-C OR I-D & I-F OR I-H



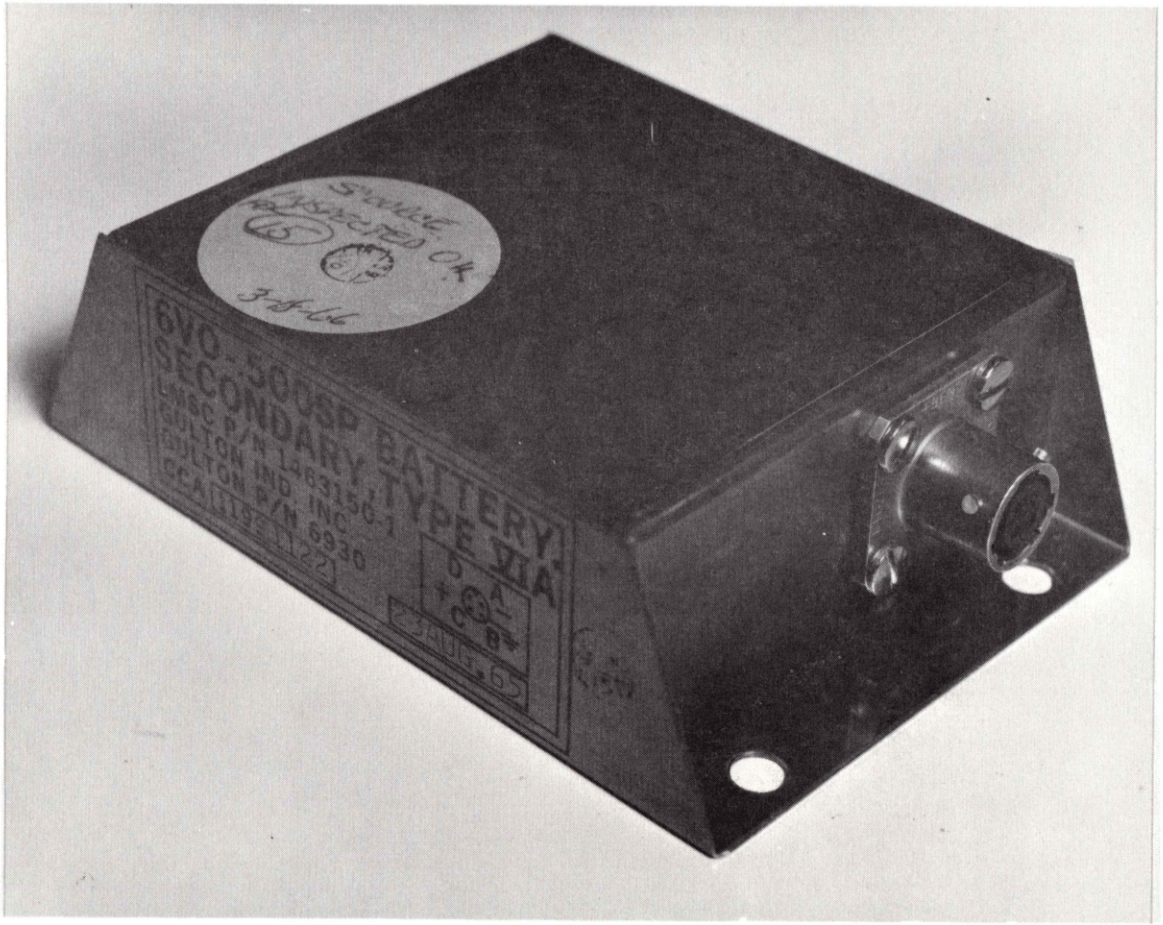
TYPE VI-A BATTERY

PRIMARY

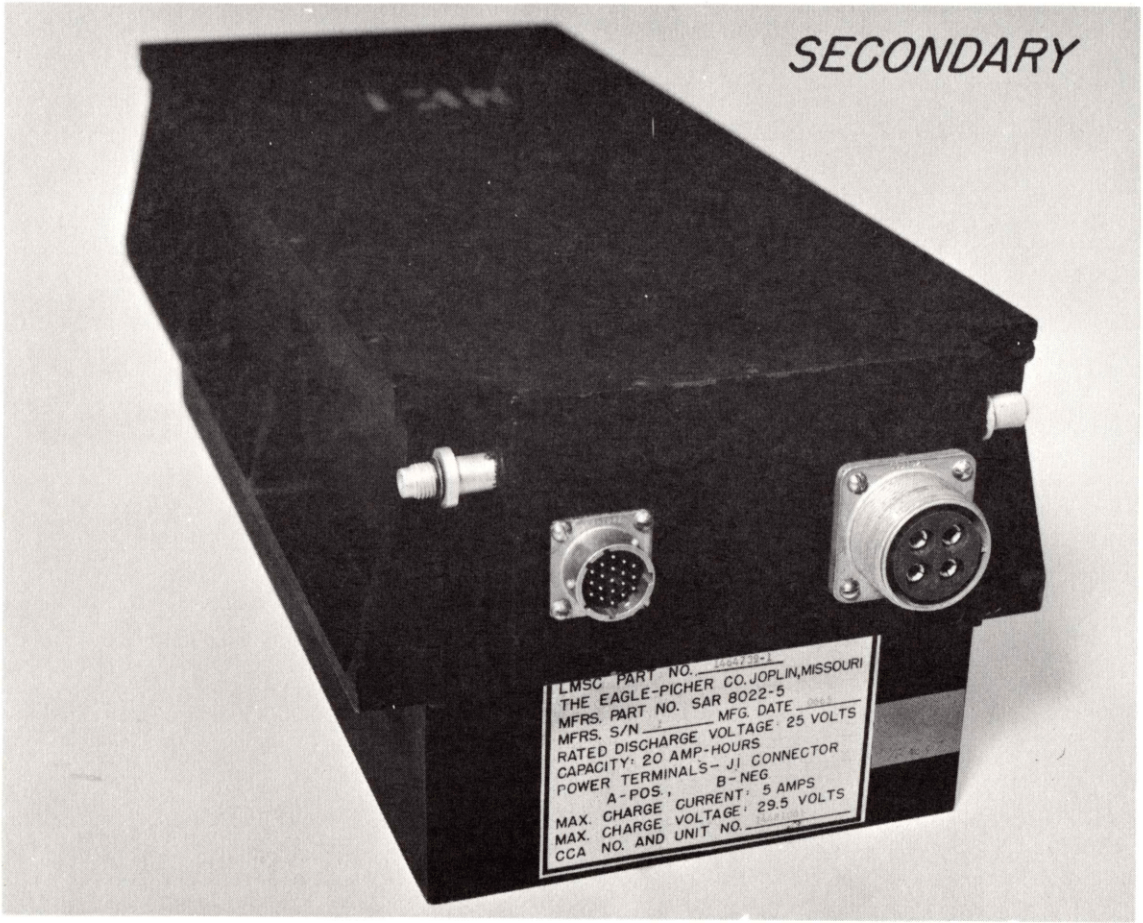


TYPE VI-A BATTERY

SECONDARY

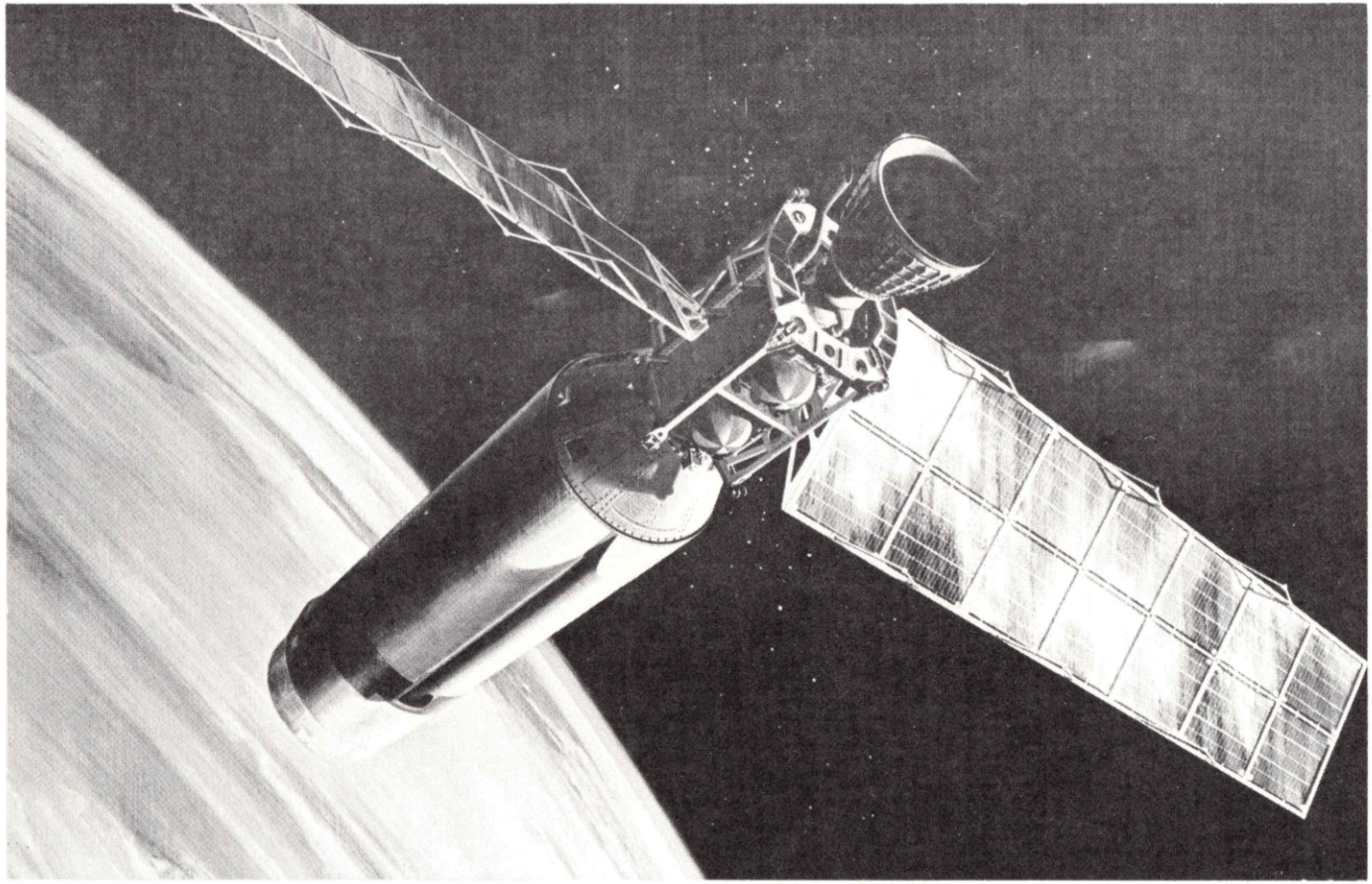


TYPE XI BATTERY

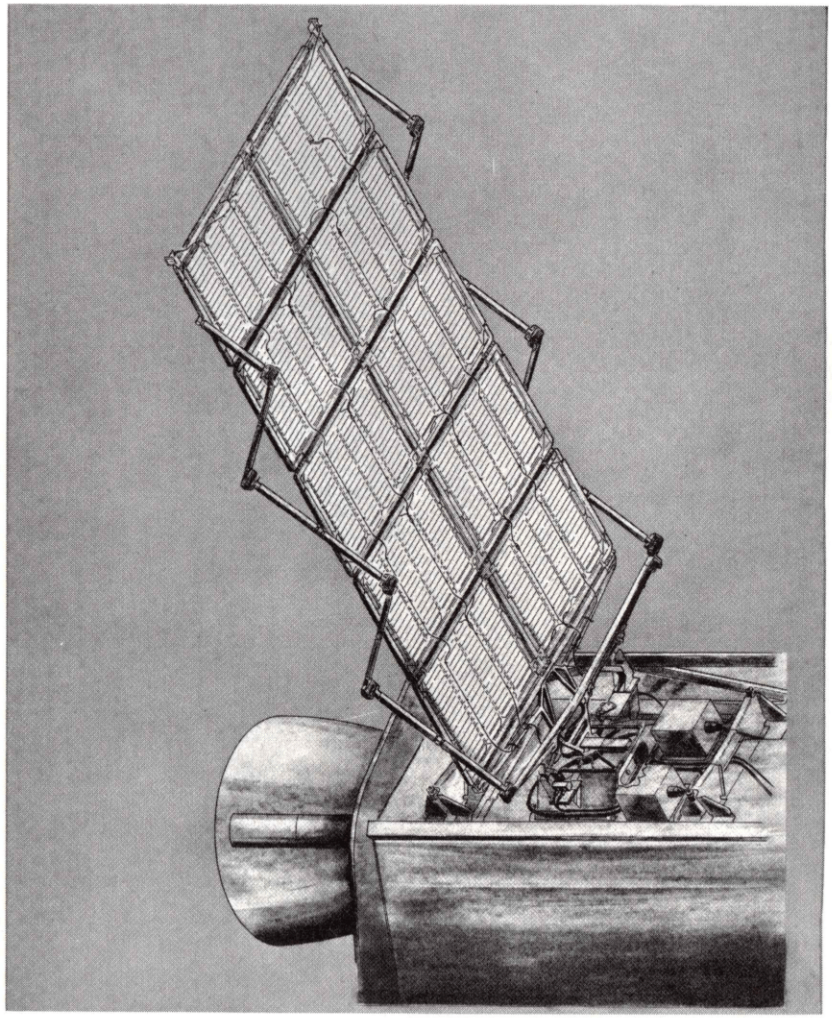


WEATHER SATELLITE

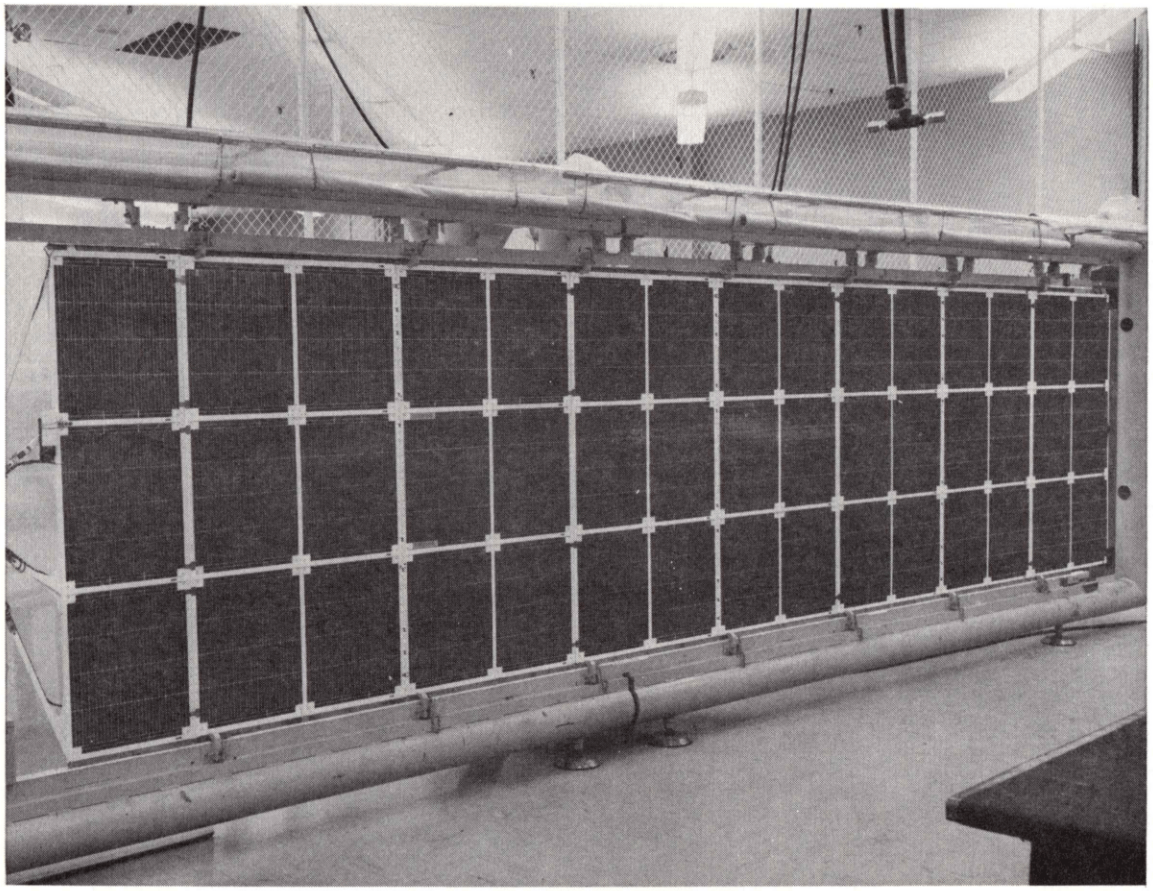
AGENA WITH SOLAR ARRAYS EXTENDED



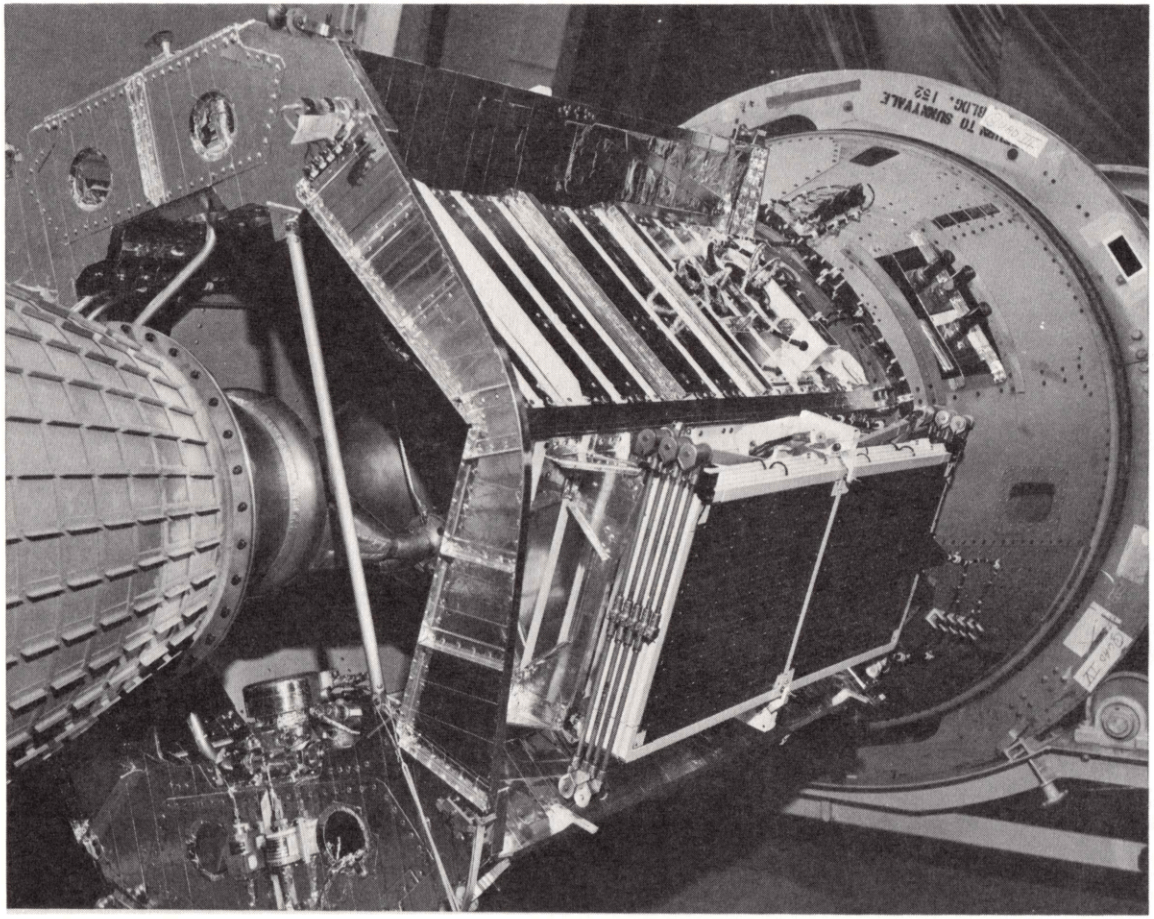
SOLAR ARRAY ARTICULATION ASSY



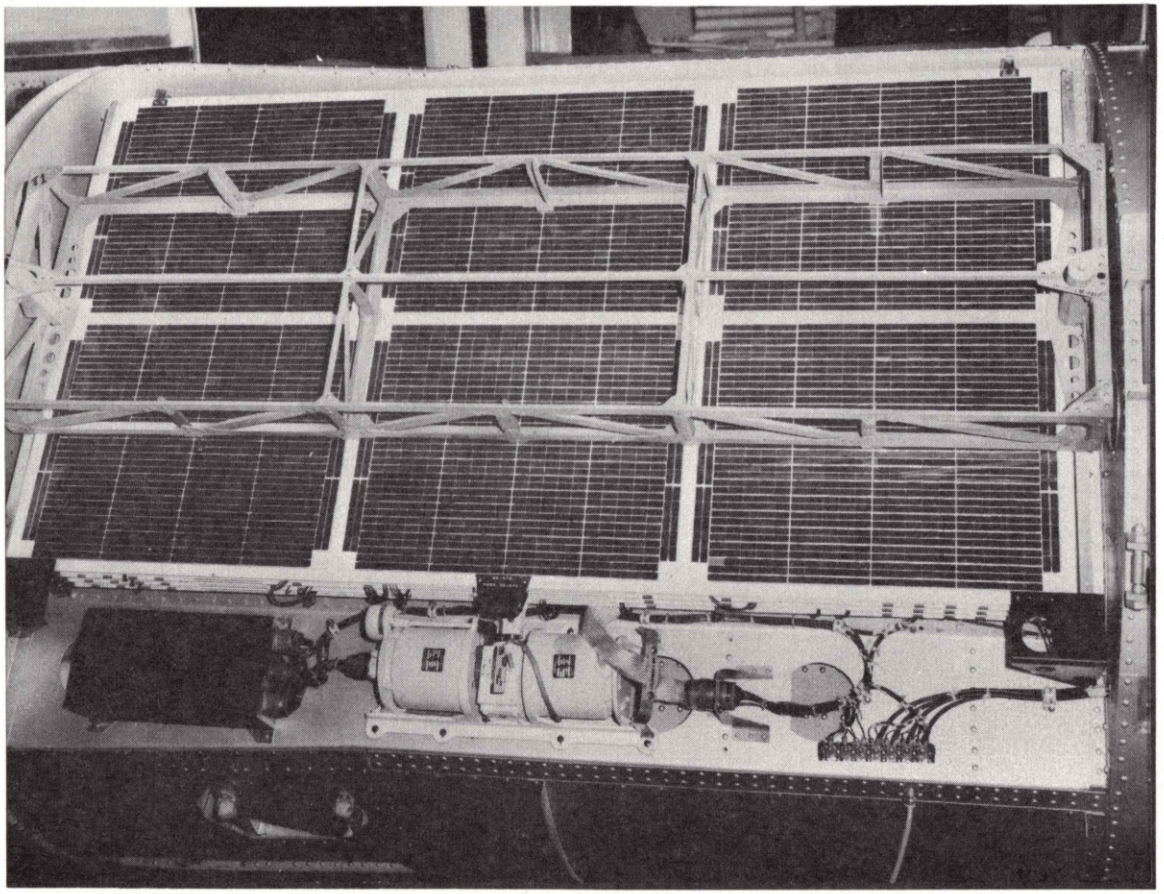
SOLAR ARRAY EXTENDED IN TEST JIG



SOLAR ARRAY ON AGENA AFT RACK

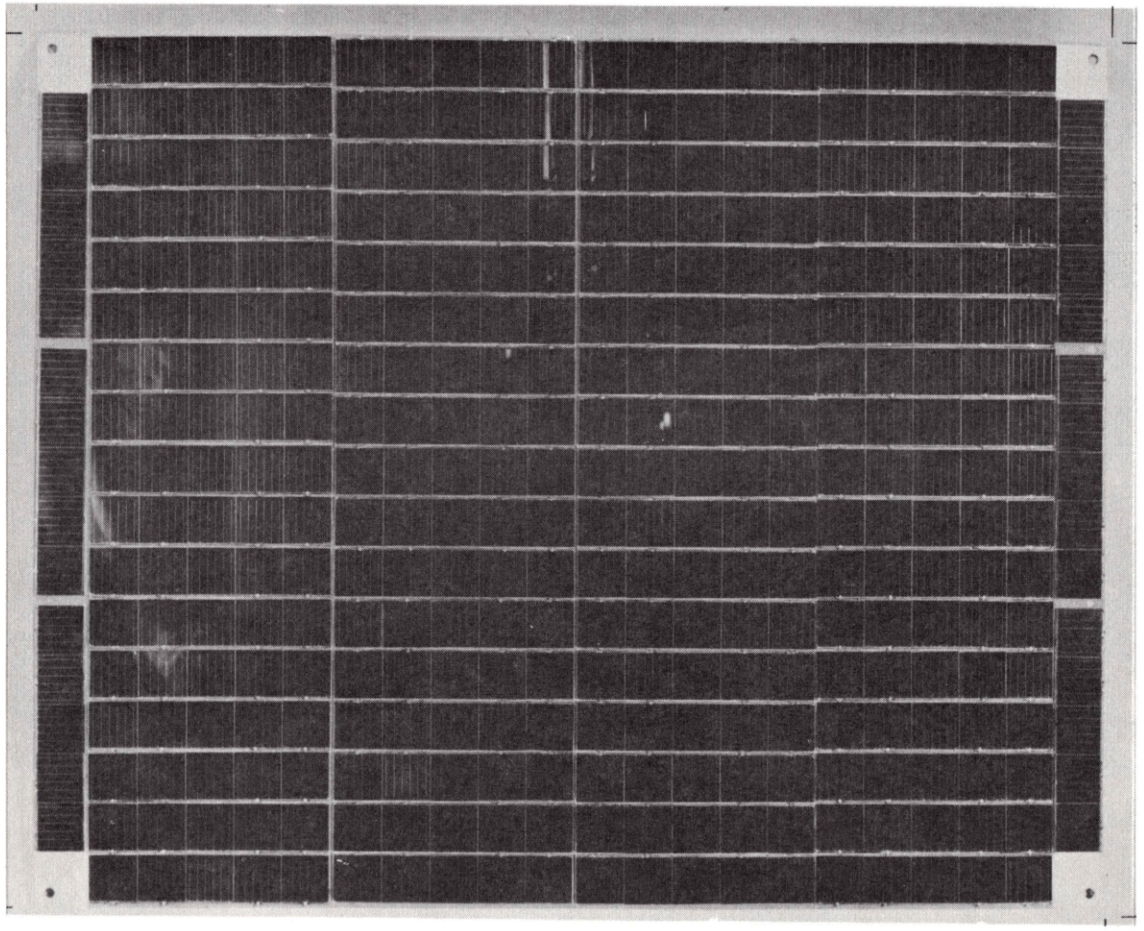


STOWED ARRAY



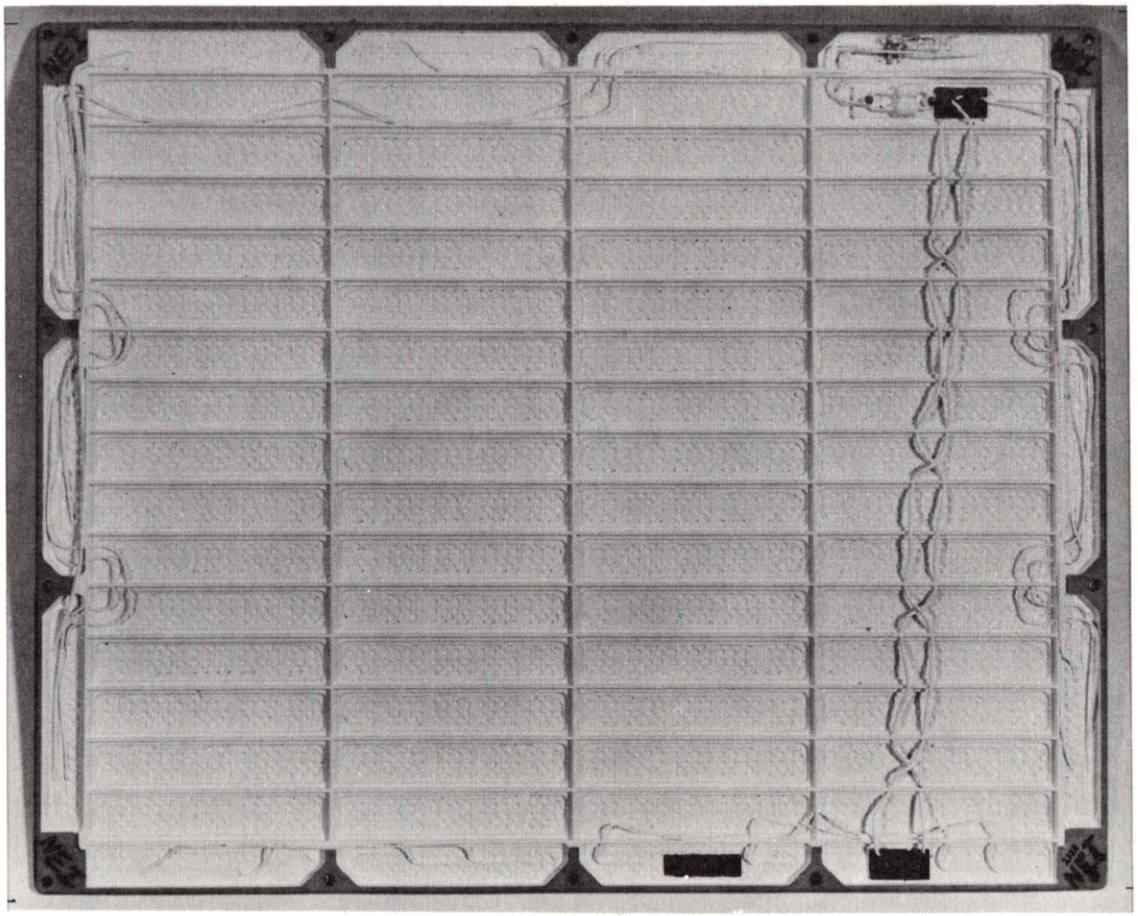
SOLAR ARRAY PANEL

FRONT

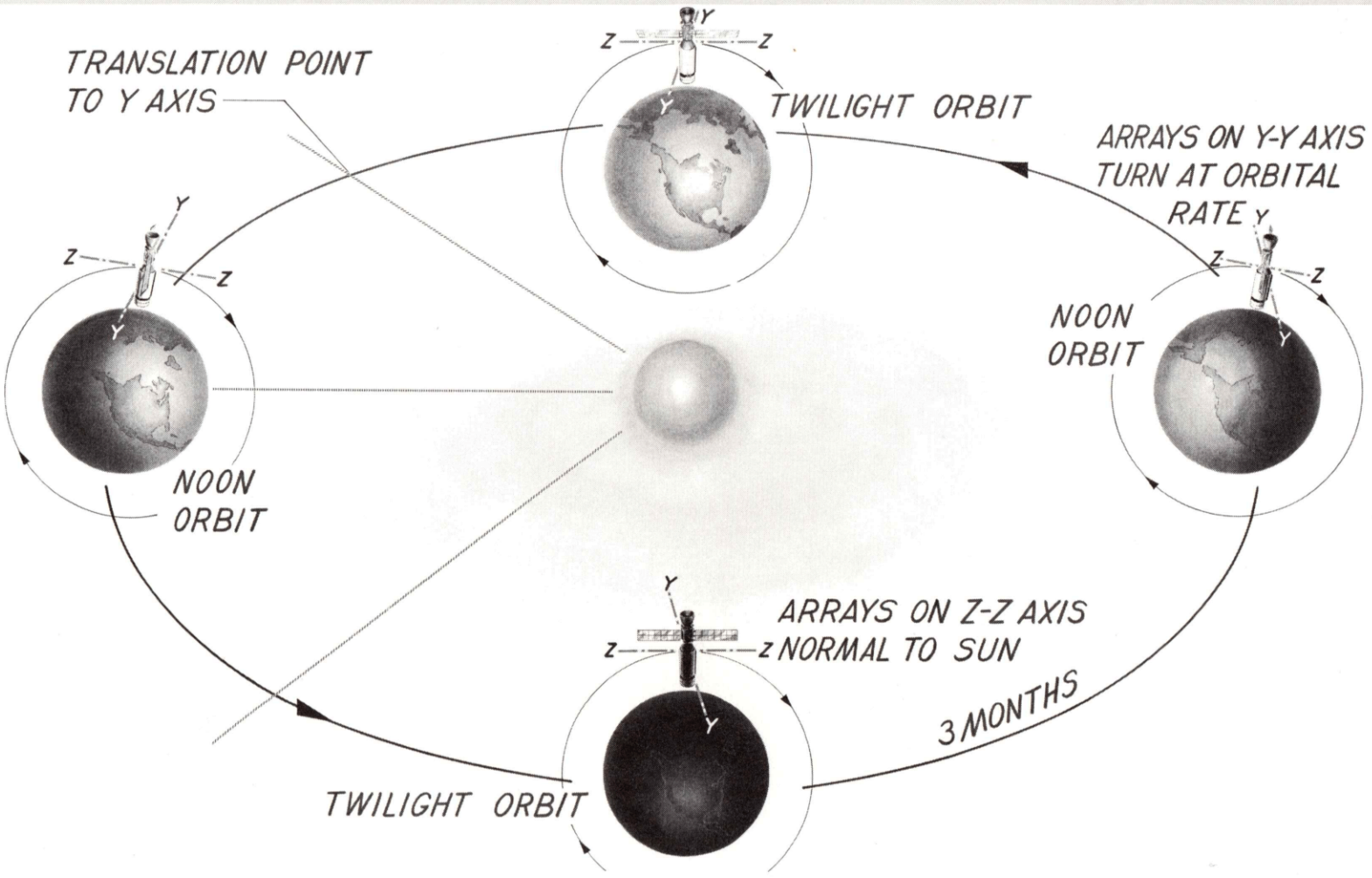


SOLAR ARRAY PANEL

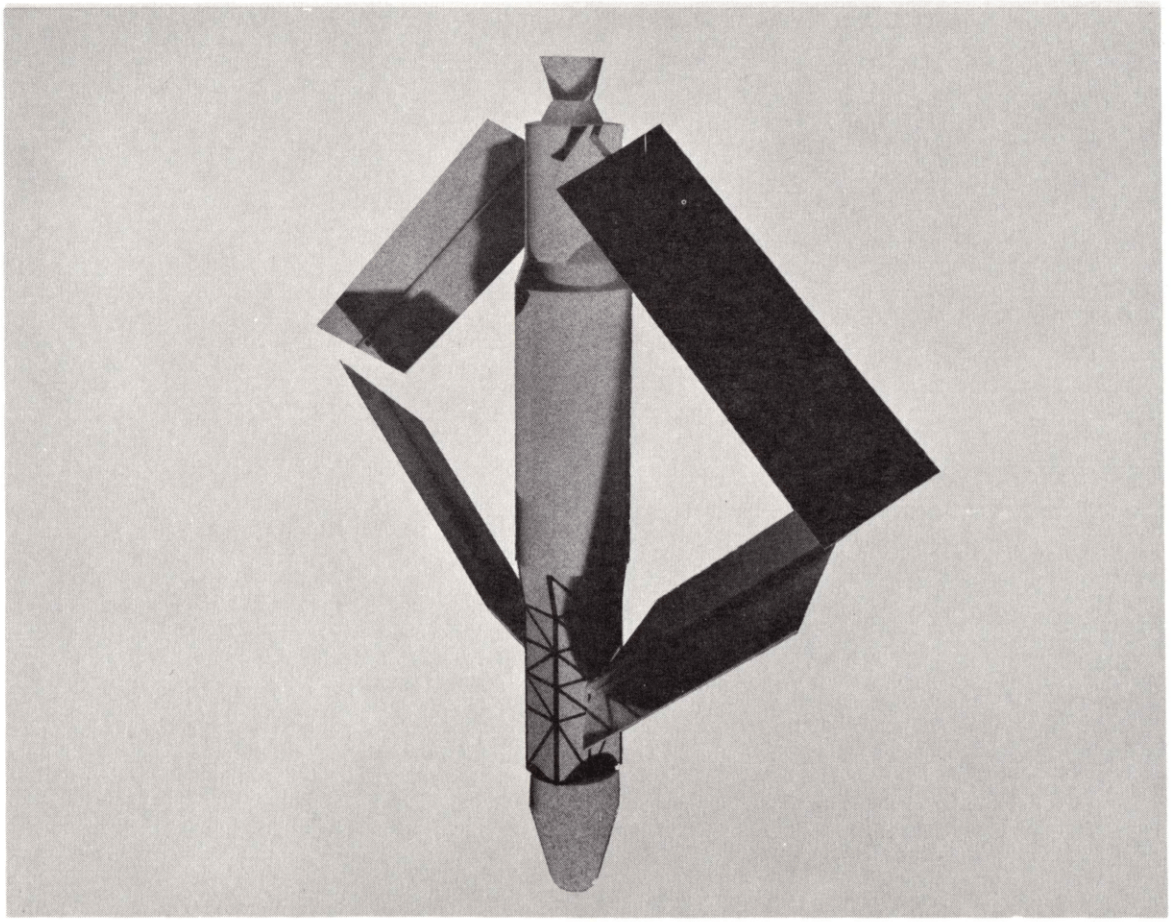
REAR



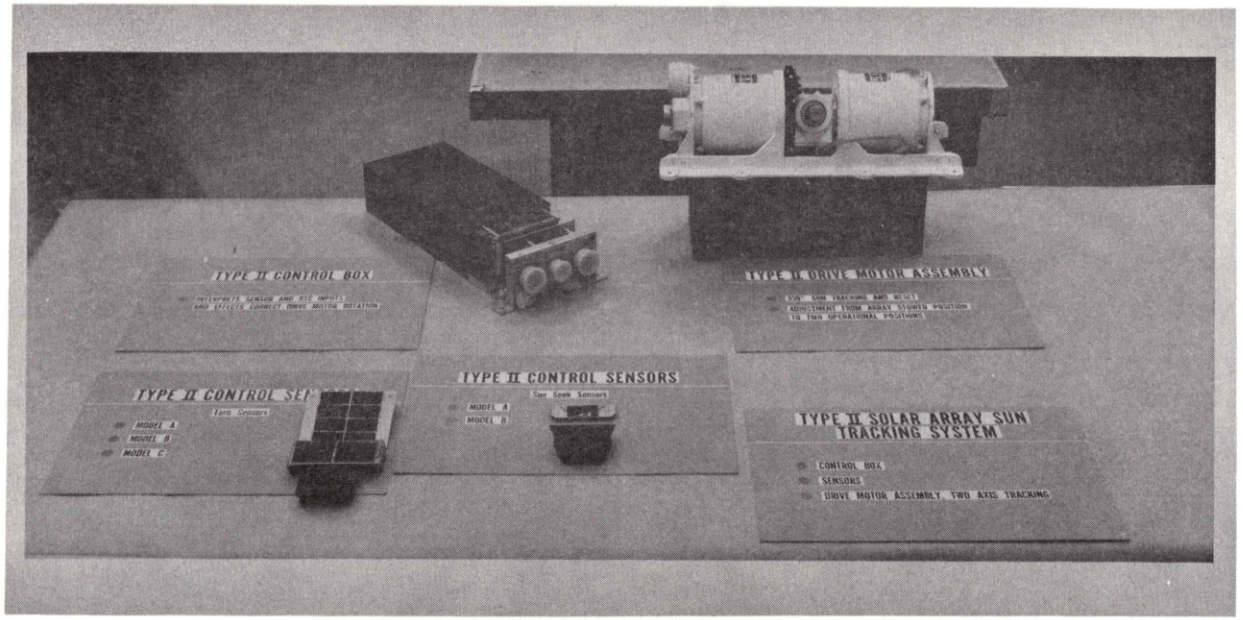
SOLAR ARRAY SEASONAL ADJUSTMENT

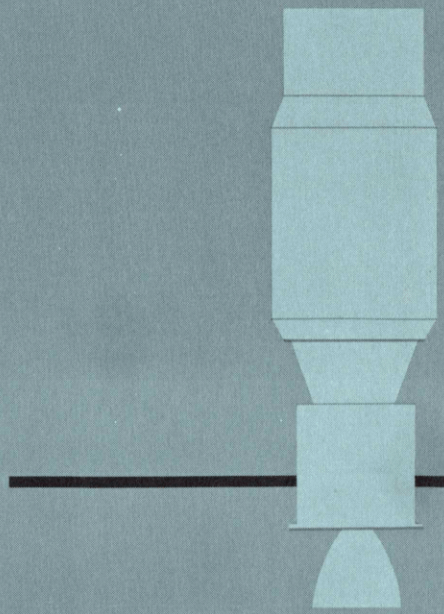


FIXED SOLAR ARRAY CONFIGURATION



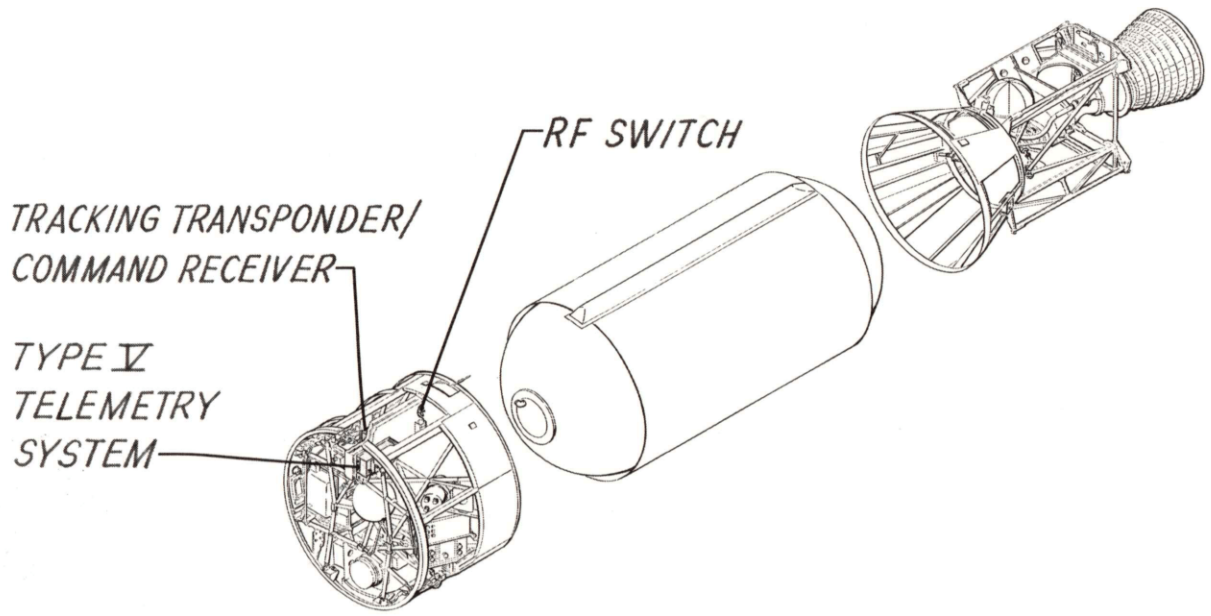
SOLAR ARRAY CONTROL COMPONENTS



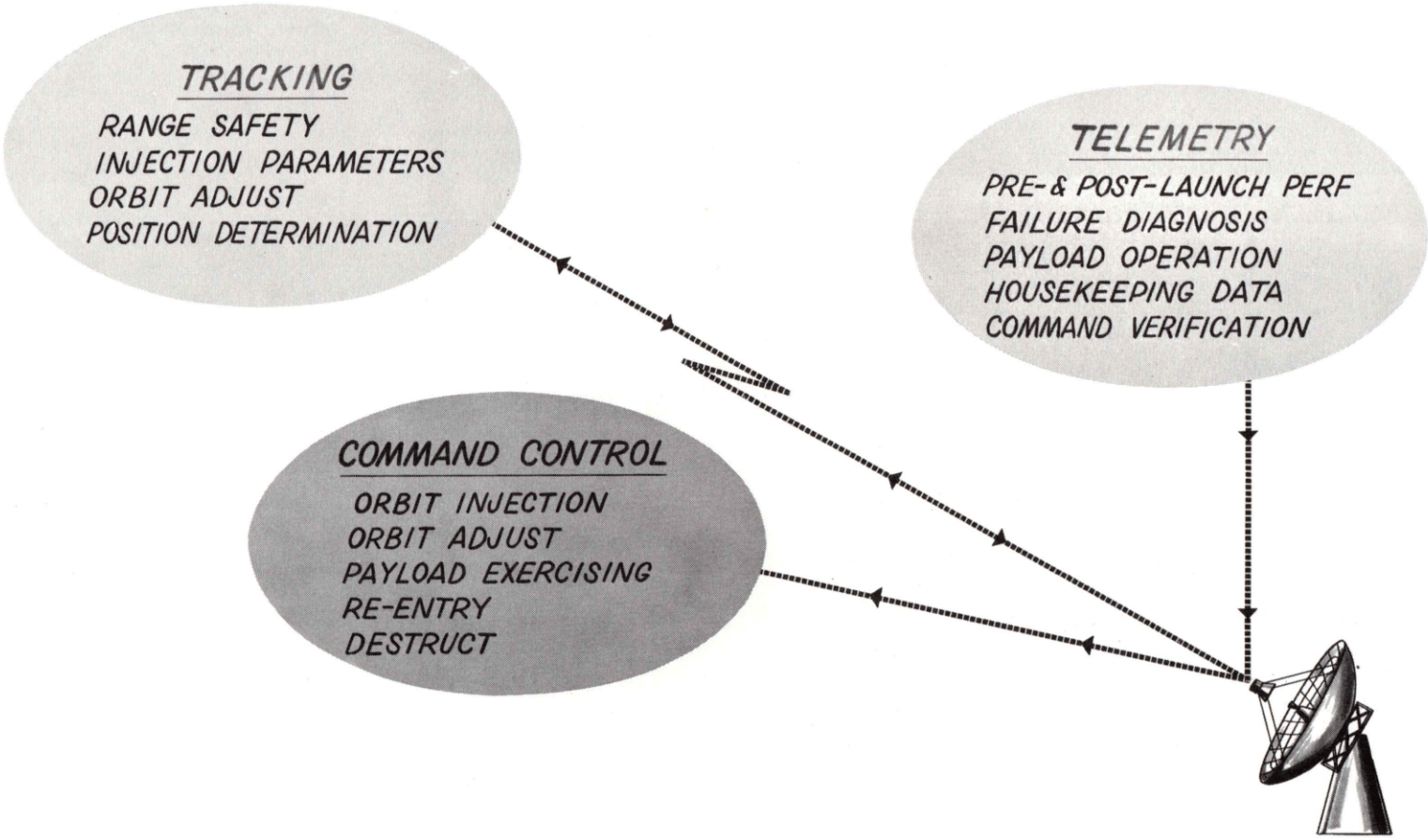


COMMUNICATIONS & CONTROL

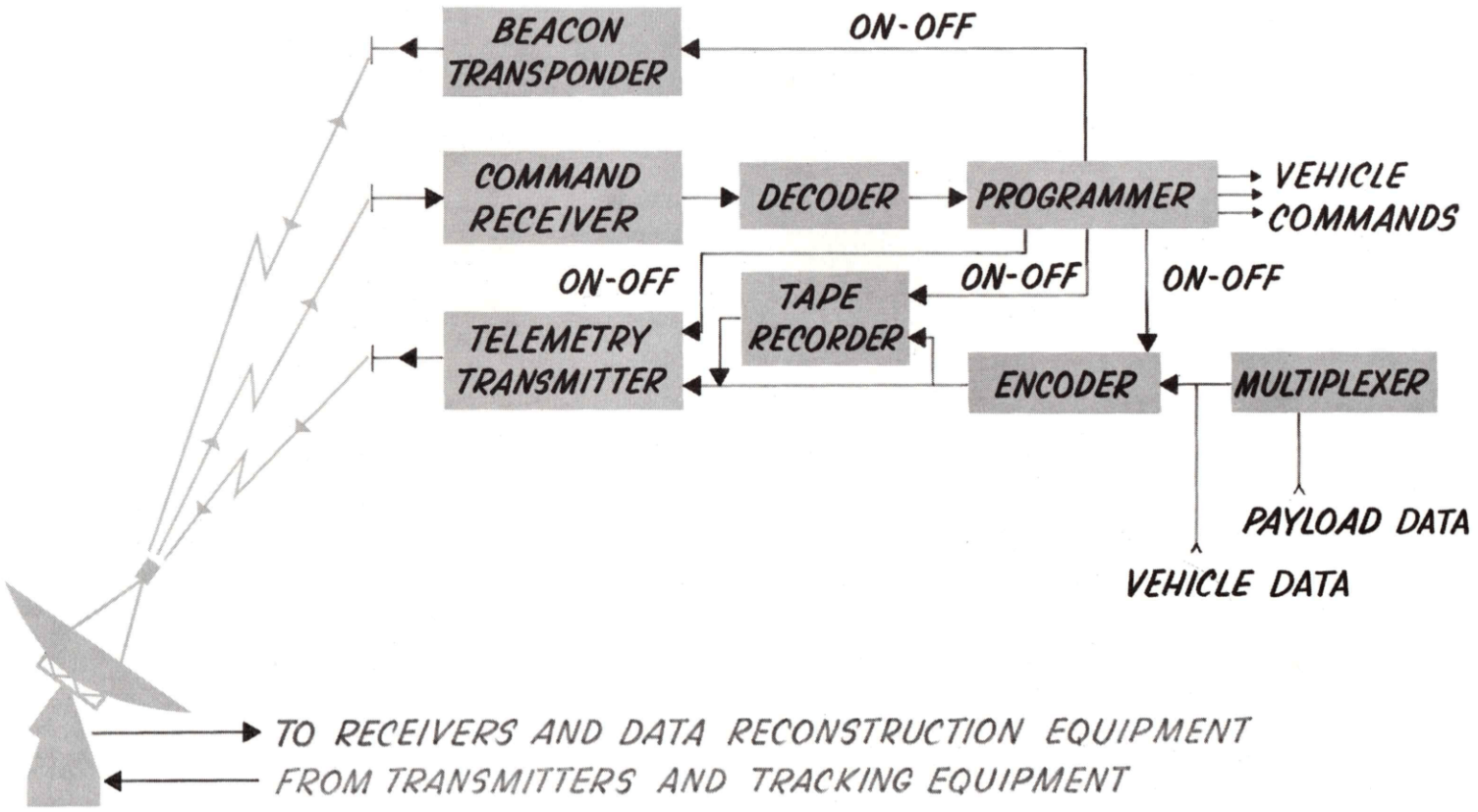
COMMUNICATIONS & CONTROL



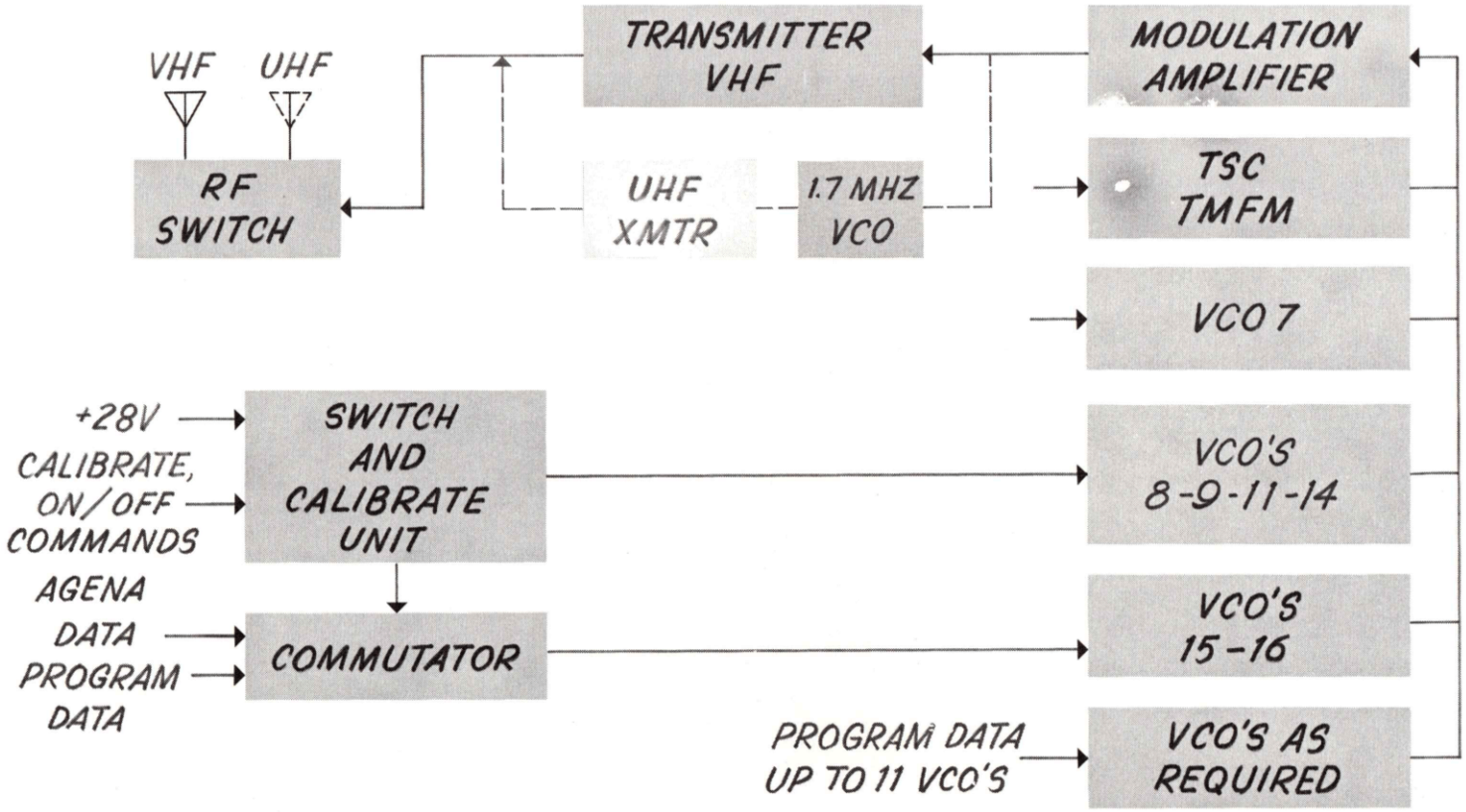
COMMUNICATIONS & CONTROL FUNCTIONS



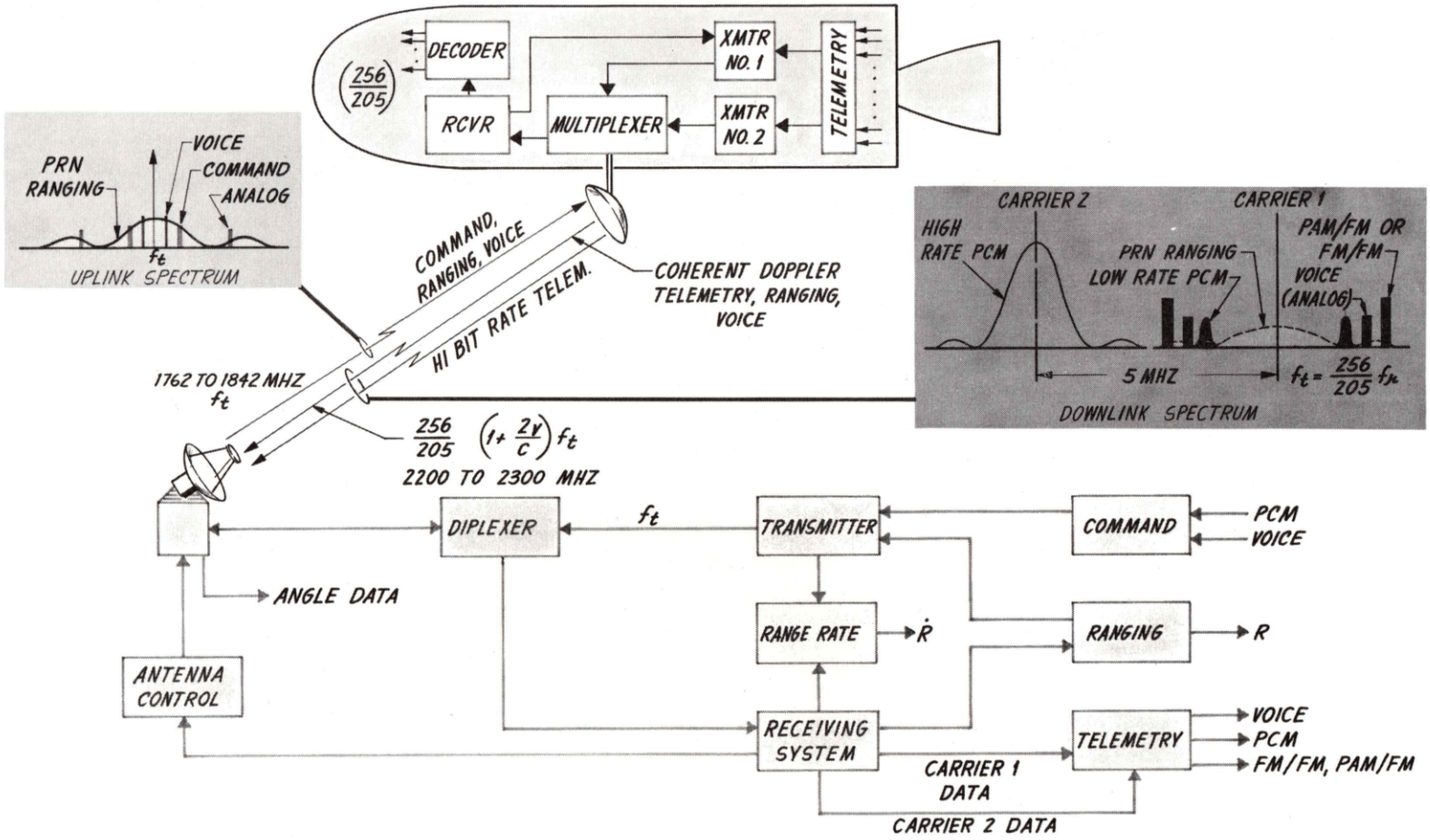
SIMPLIFIED C&C SYSTEM DIAGRAM



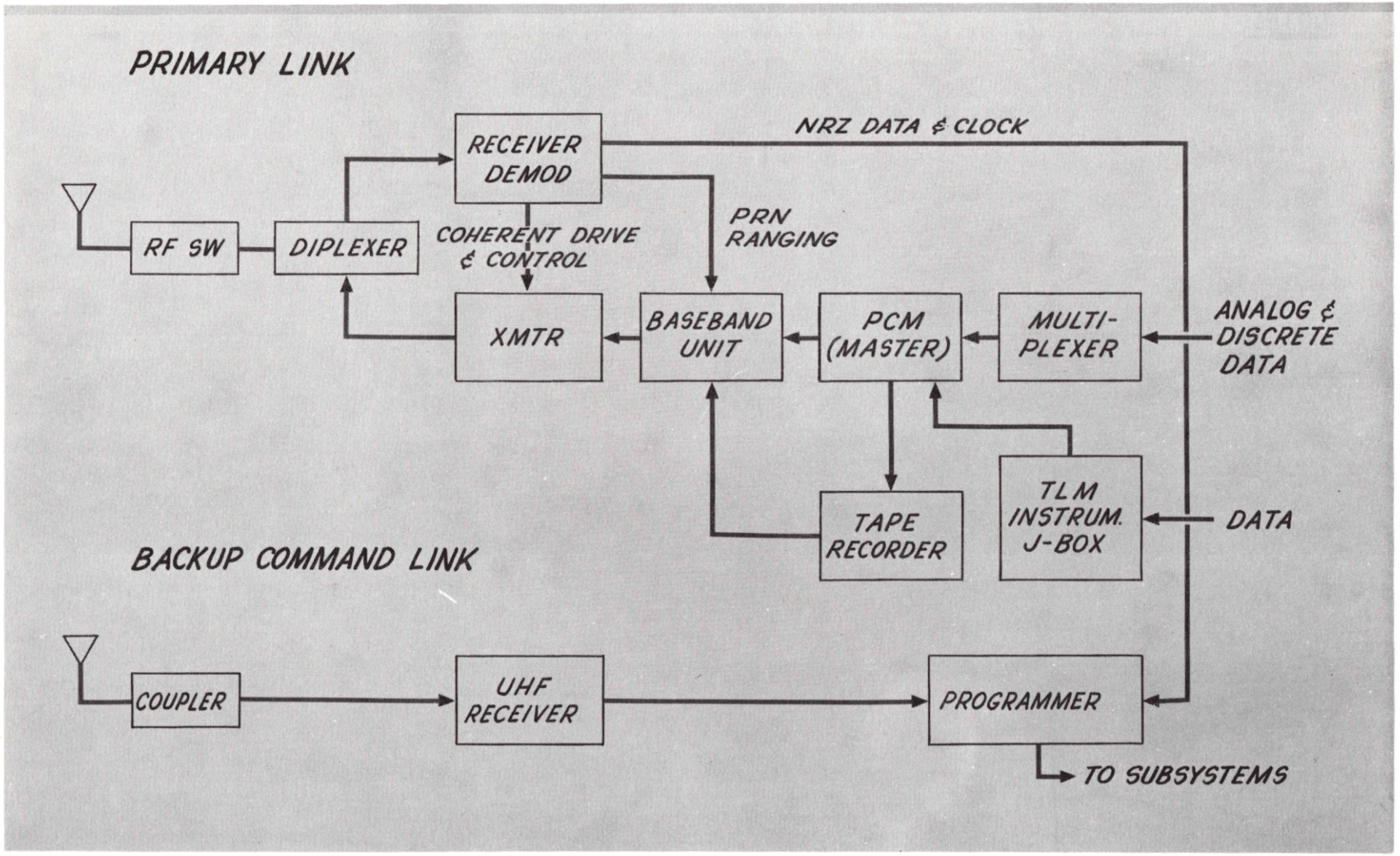
STANDARD AGENA TELEMETER TYPE V



SIMPLIFIED SGLS SYSTEM DIAGRAM



SGLS BLOCK DIAGRAM



SGLS / UNIFIED S-BAND CHARACTERISTICS

BASIC DESCRIPTION

PHASE MODULATED S-BAND LINKS FOR INTEGRATED TRACKING, TELEMETRY ANALOG, AND COMMAND INFORMATION TRANSMISSION. COHERENT CARRIERS ARE USED UP-LINK AND DOWN-LINK; A NON-COHERENT DOWN-LINK CARRIER MAY BE USED ALSO

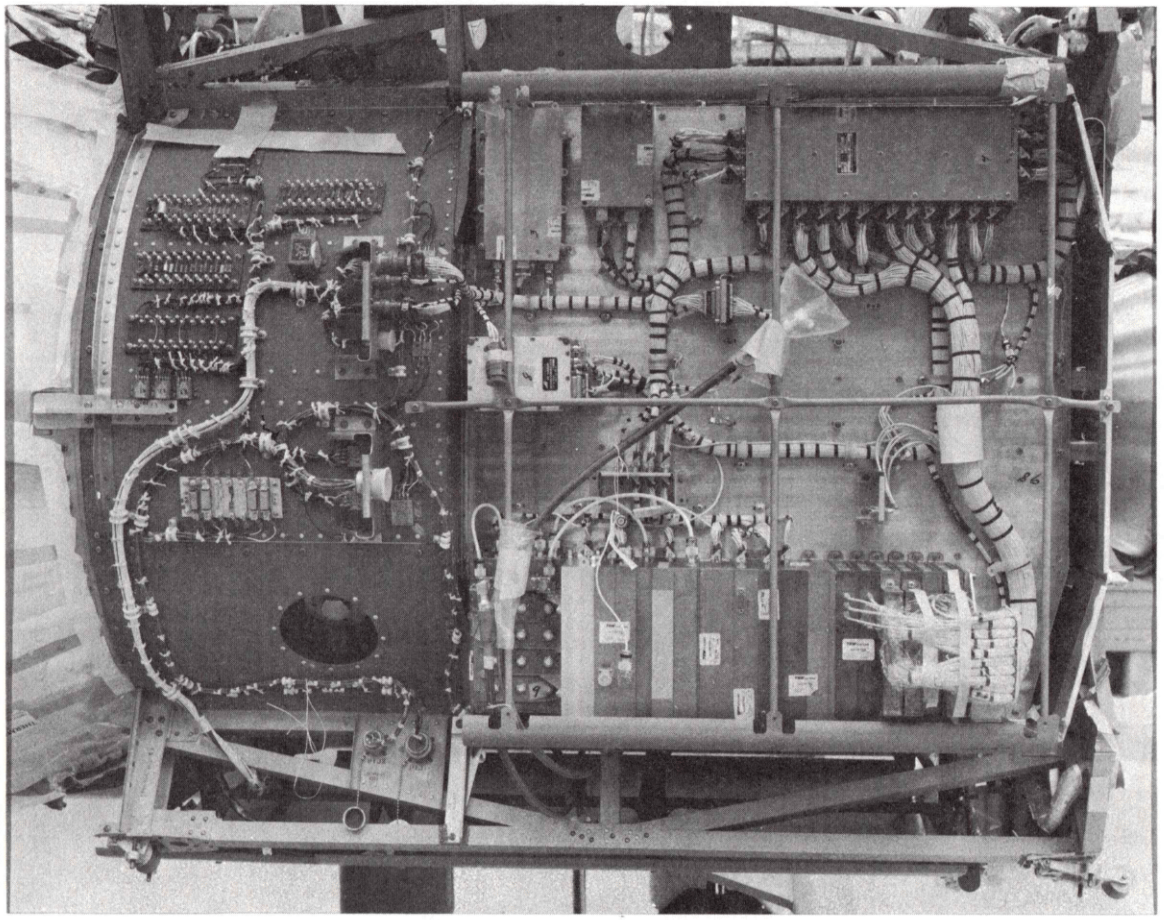
ITEM	SGLS	UNIFIED S-BAND
COHERENT CARRIER	✓	✓
UP-LINK FREQ. GHZ	1.76 - 1.84	2.03 - 2.12
DOWN-LINK FREQ. GHZ	2.2 - 2.3	2.2 - 2.3
TURN-AROUND RATIO	256 / 205	240 / 221
MODULATION CHARACTERISTICS	BOTH USE LOW DEVIATION PHASE MODULATION UP-LINK AND DOWN-LINK	
DEVIATION	0.1 TO 1.65 RAD	0.5 TO 1.85 RAD

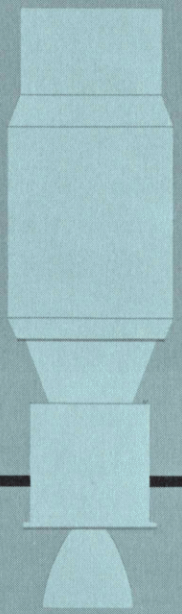
SGLS/UNIFIED S-BAND CHARACTERISTICS

ITEM	SGLS	UNIFIED S-BAND
UP-LINK INFORMATION	PRN RANGING 500KC CLOCK 1 MB/S CODE OPTIONAL-ANALOG 3KHZ ON 30 KHZ VCO 20KHZ ON 1.25 MHZ VCO COMMANDS ON 3 TONES (AMPL. MOD AT ½ BIT RATE) 7 BIT RATES, 1 TO 100K B/S	PRN RANGING 496 KC CLOCK 992 KB/S CODE VOICE ON 30 KHZ VCO COMMANDS ON 70 KHZ VCO 1 & 2 KHZ, PSK 200 SUB-CODED BITS/SEC 30 BIT MESSAGE
DOWN-LINK INFORMATION	PRN RANGING (TURNED AROUND) OPTIONAL VOICE ON 1.25 MHZ VCO PCM DATA ON 1.024 MHZ BI-PHASE SUBCARRIER 13 BIT RATES 7.8 TO 128 KB/S 40 KB/S PAM/FM OR IRIG FM CHANNELS 1-21 ON 1.7 MHZ SUBCARRIER	PRN RANGING (TURNED AROUND) VOICE ON 1.25 MHZ VCO PCM DATA ON 1.024 MHZ BI-PHASE SUBCARRIER 51.2 KB/S BIT RATES 1.6 KB/S

SPACE GROUND LINK SYSTEM (SGLS)

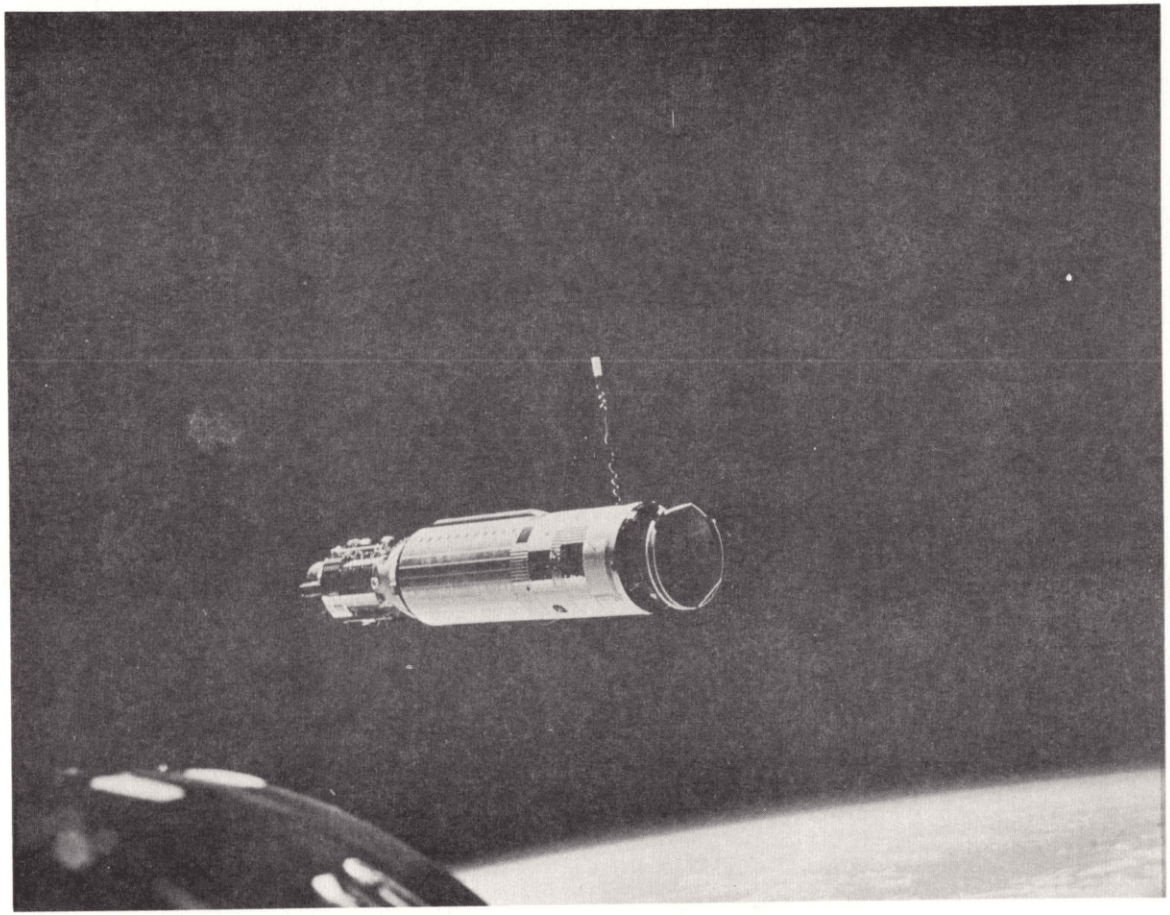
ON AGENA AFT RACK



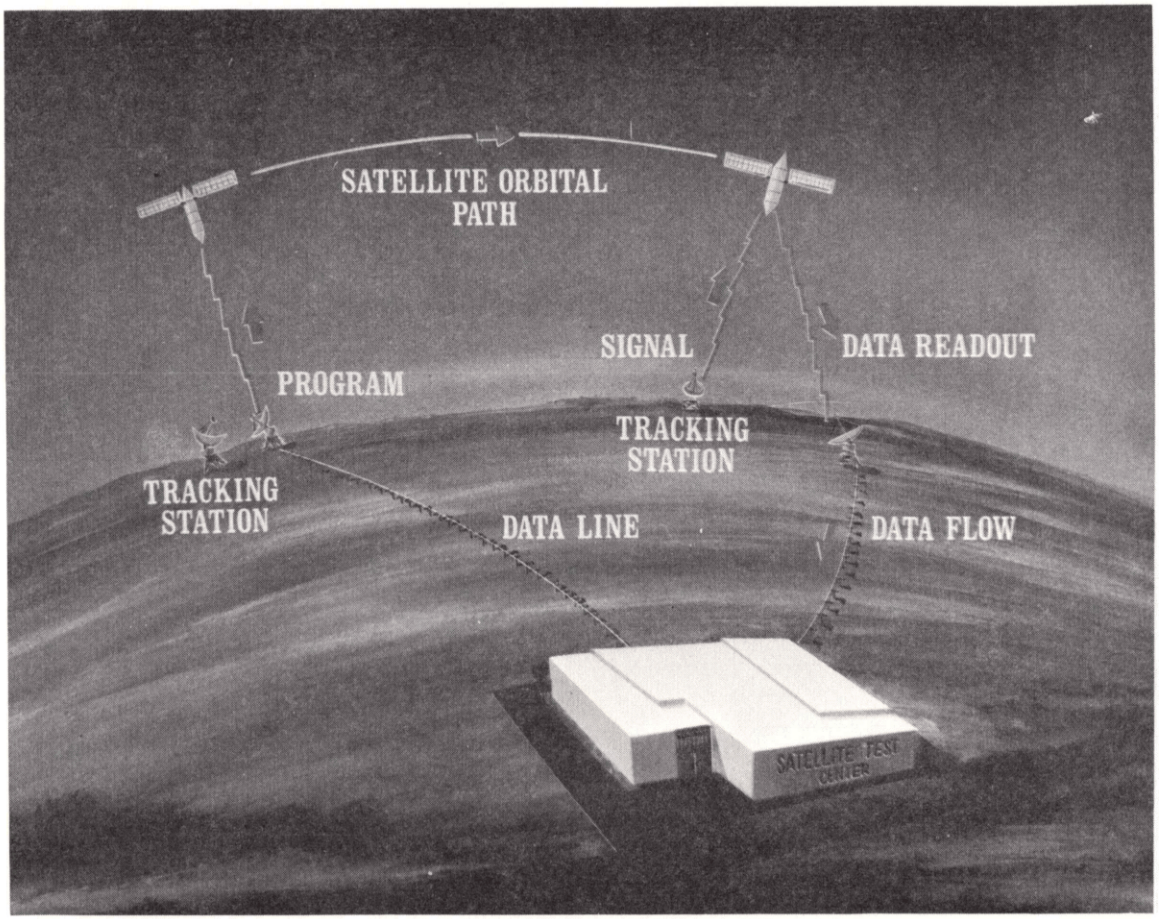


ON-ORBIT OPERATIONS

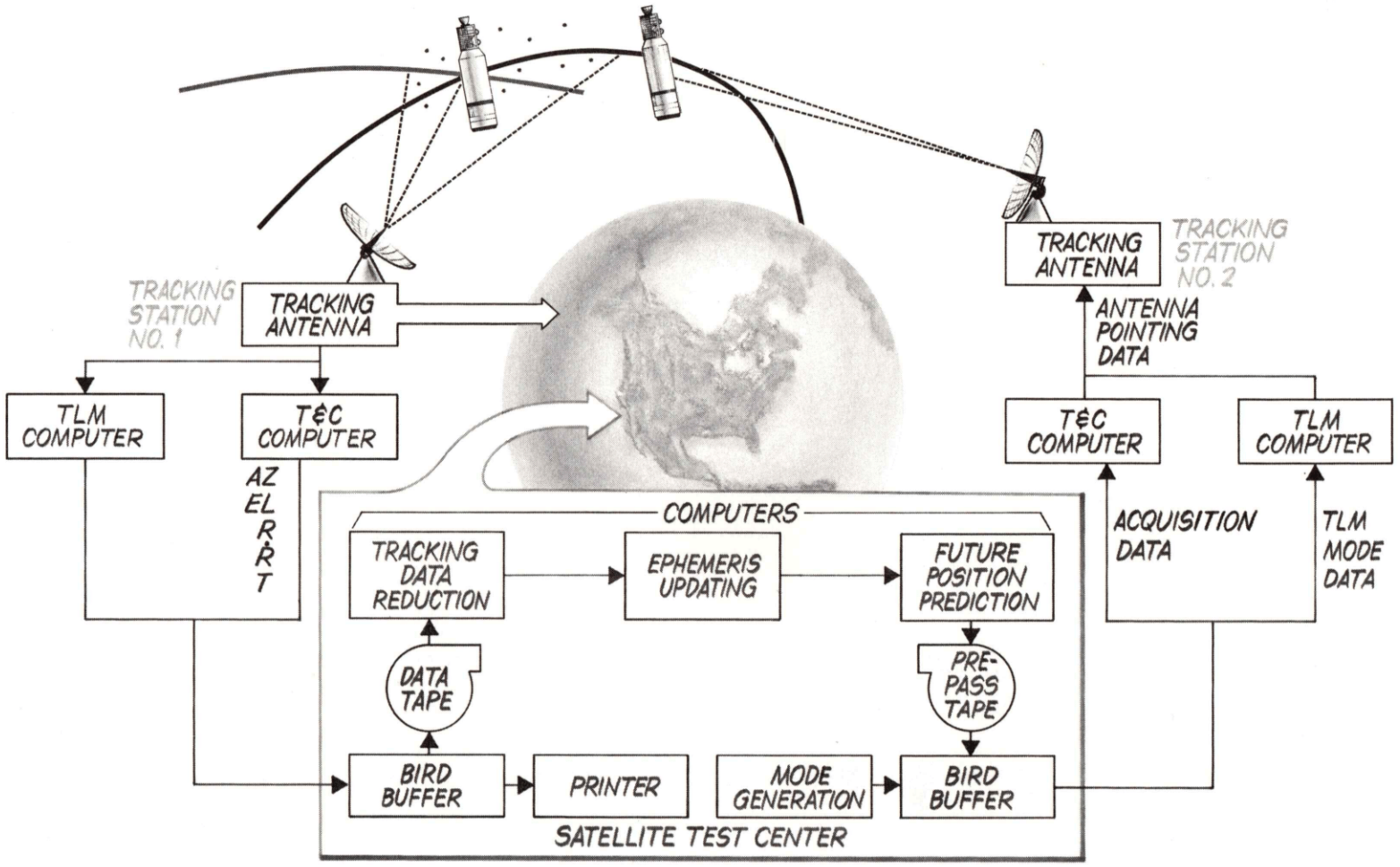
AGENA ON ORBIT



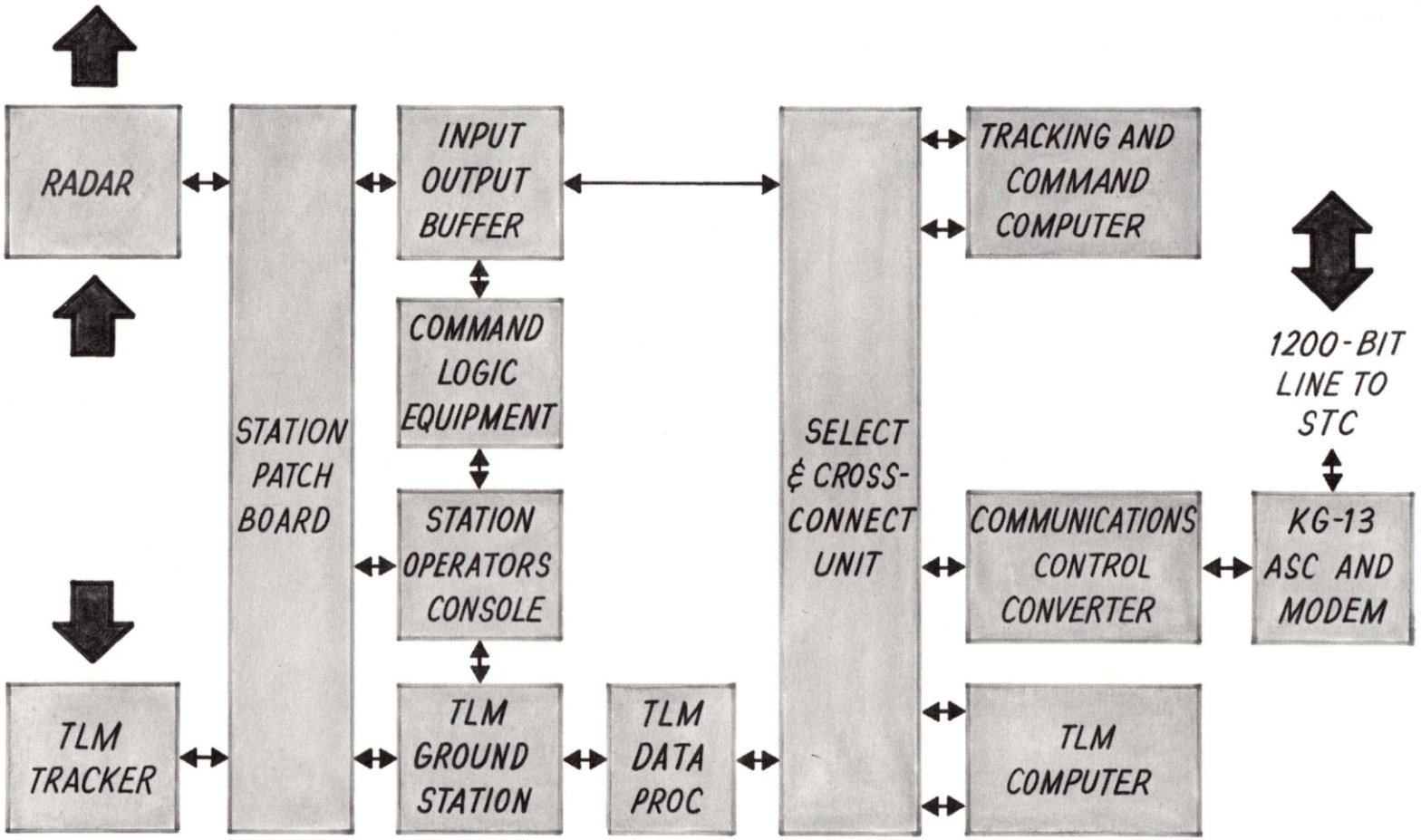
ON-ORBIT OPERATIONS



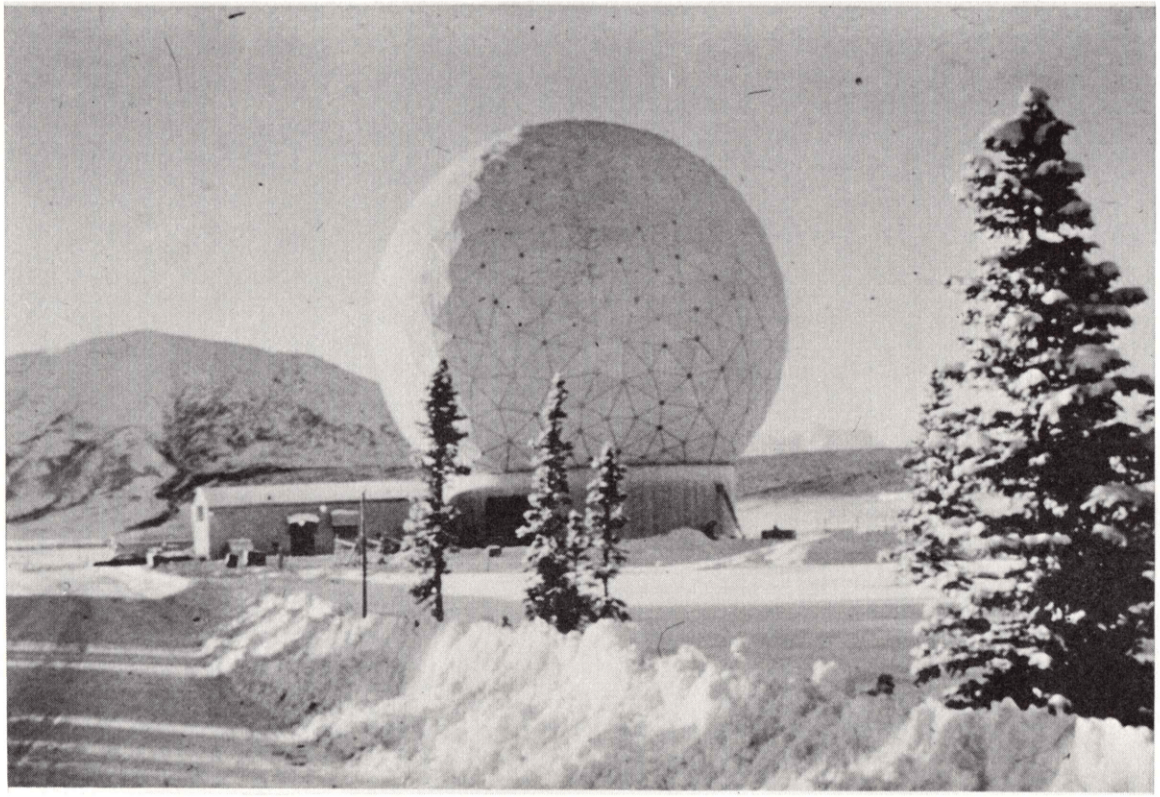
SCF SATELLITE TRACKING & TELEMETRY



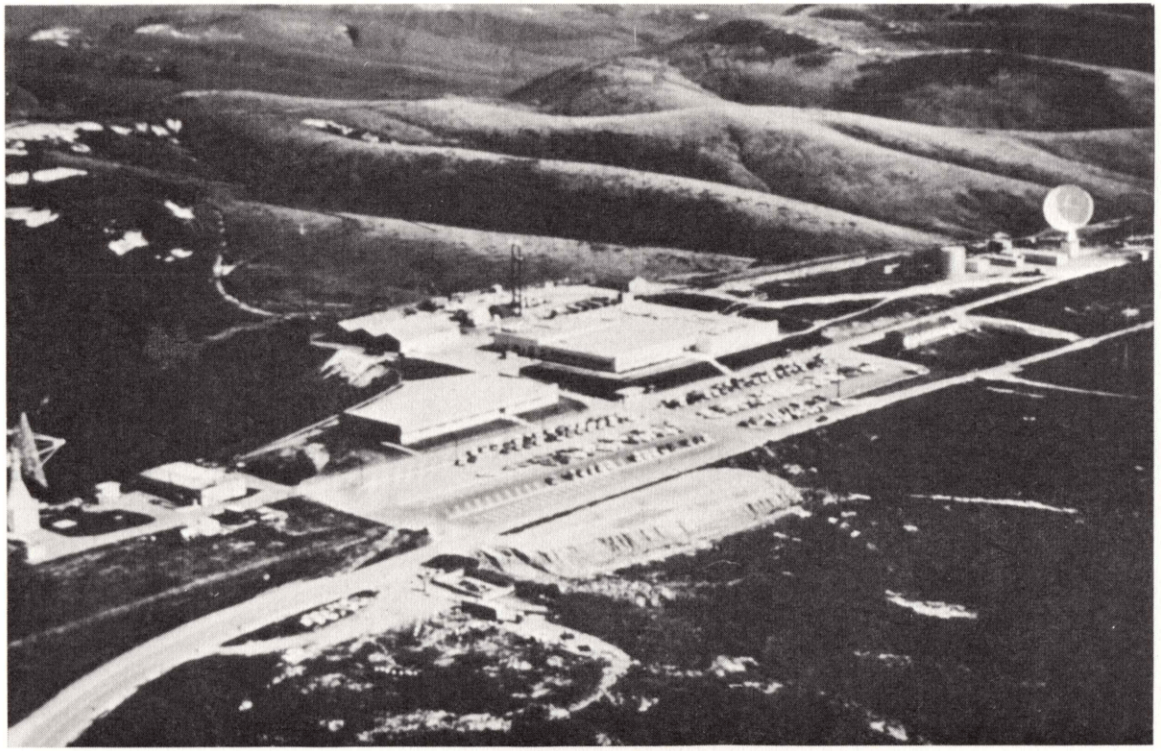
STATION BLOCK DIAGRAM



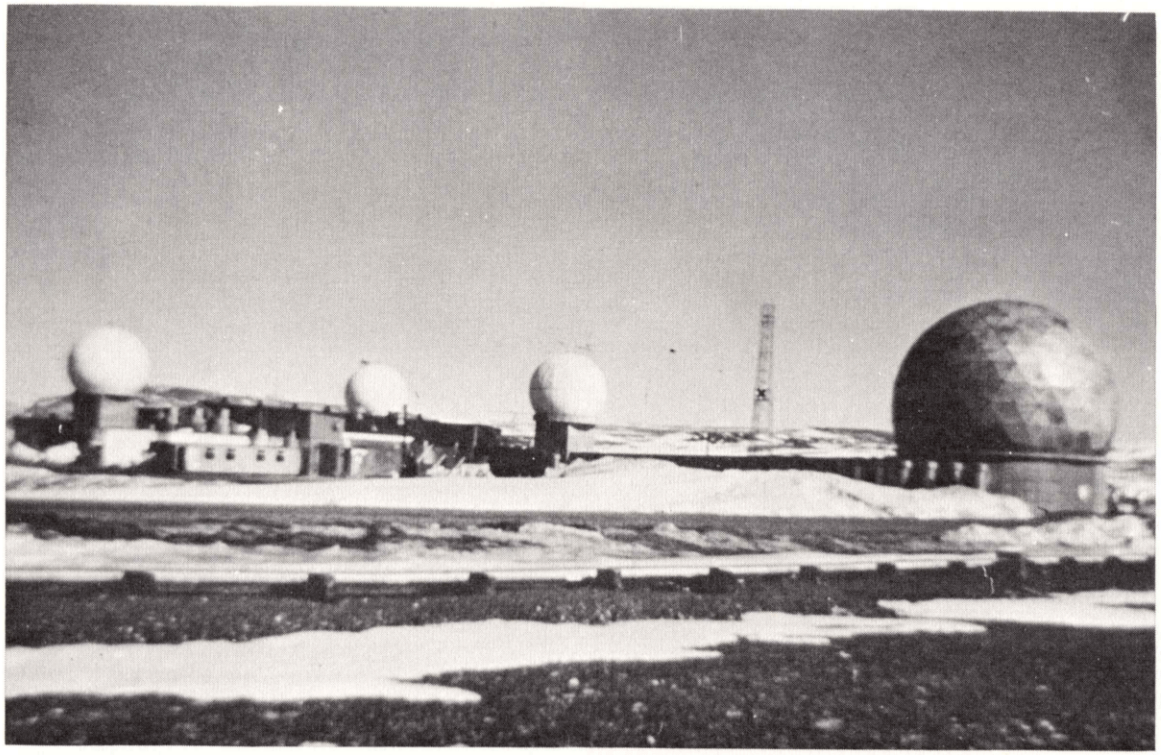
ALASKAN TRACKING STATION



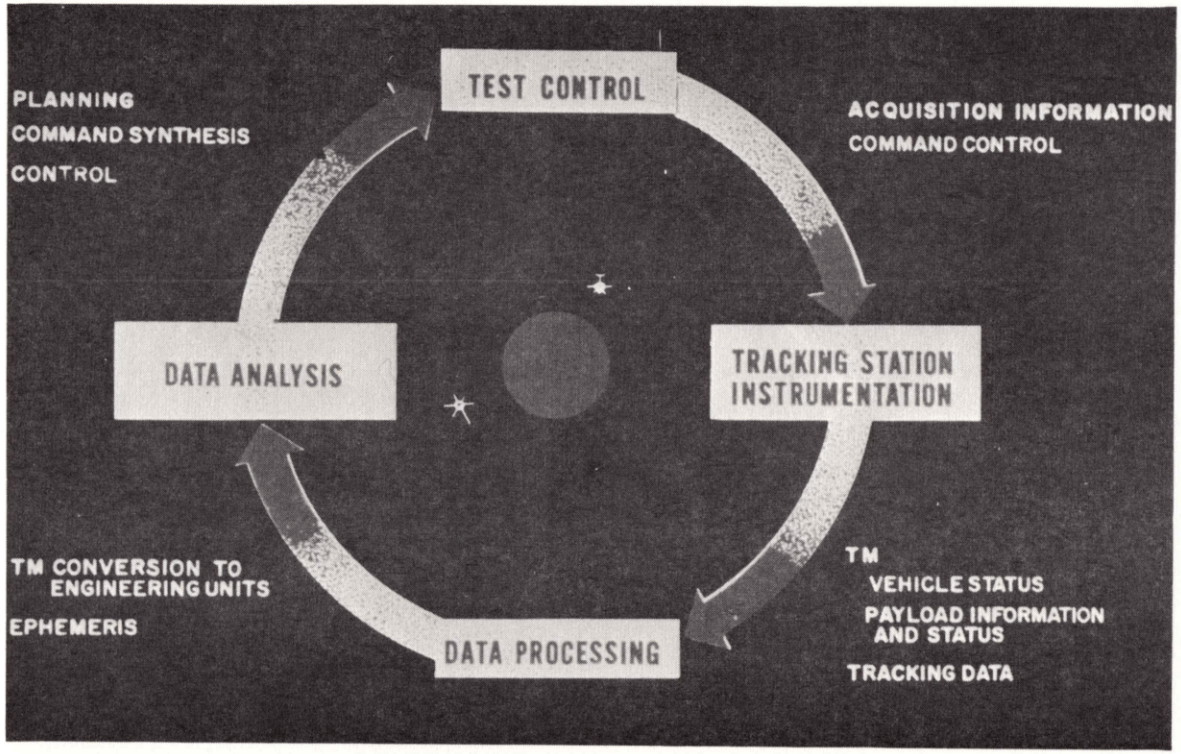
VANDENBERG TRACKING STATION



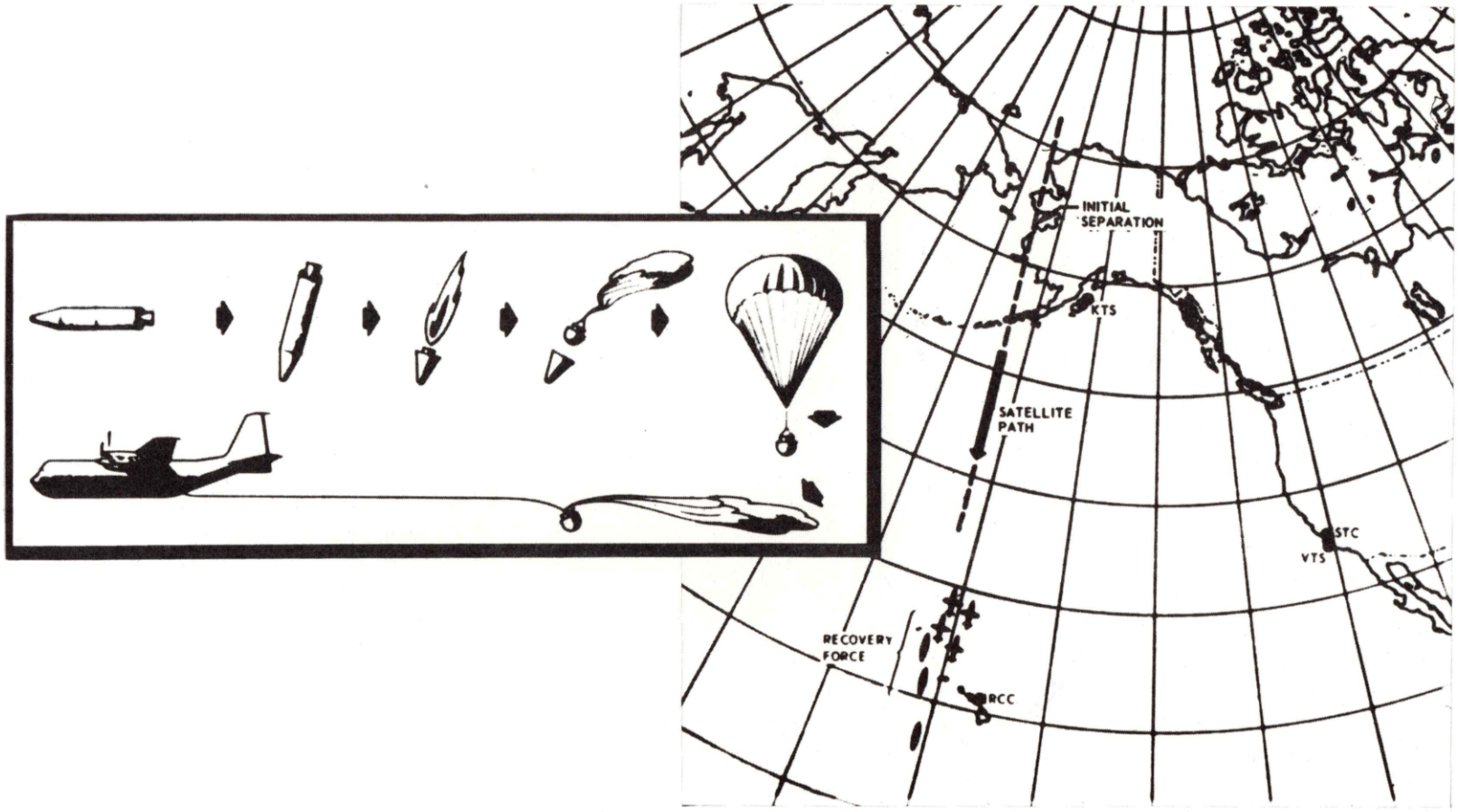
POGO SITE



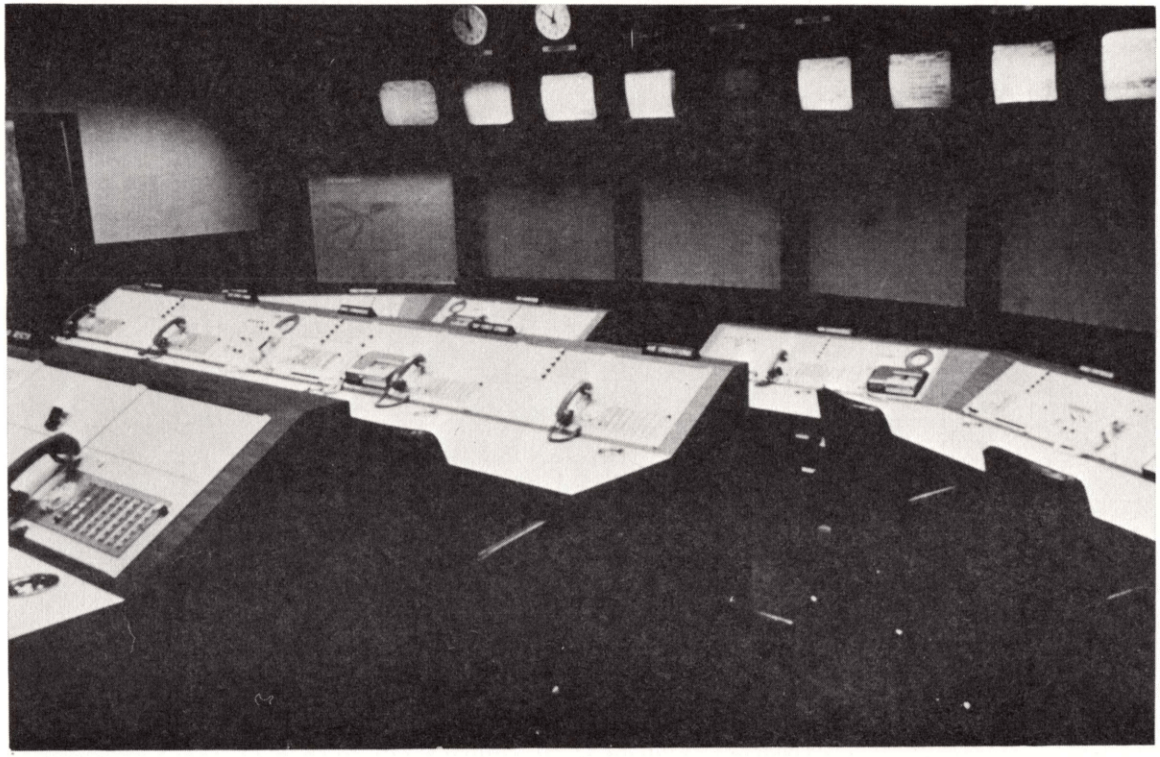
DATA CYCLE


TEST CONTROL
PLANNING
COMMAND SYNTHESIS
CONTROL
ACQUISITION INFORMATION
COMMAND CONTROL
DATA ANALYSIS
TRACKING STATION
INSTRUMENTATION
TM CONVERSION TO
ENGINEERING UNITS
EPHEMERIS
DATA PROCESSING
TM
VEHICLE STATUS
PAYLOAD INFORMATION
AND STATUS
TRACKING DATA

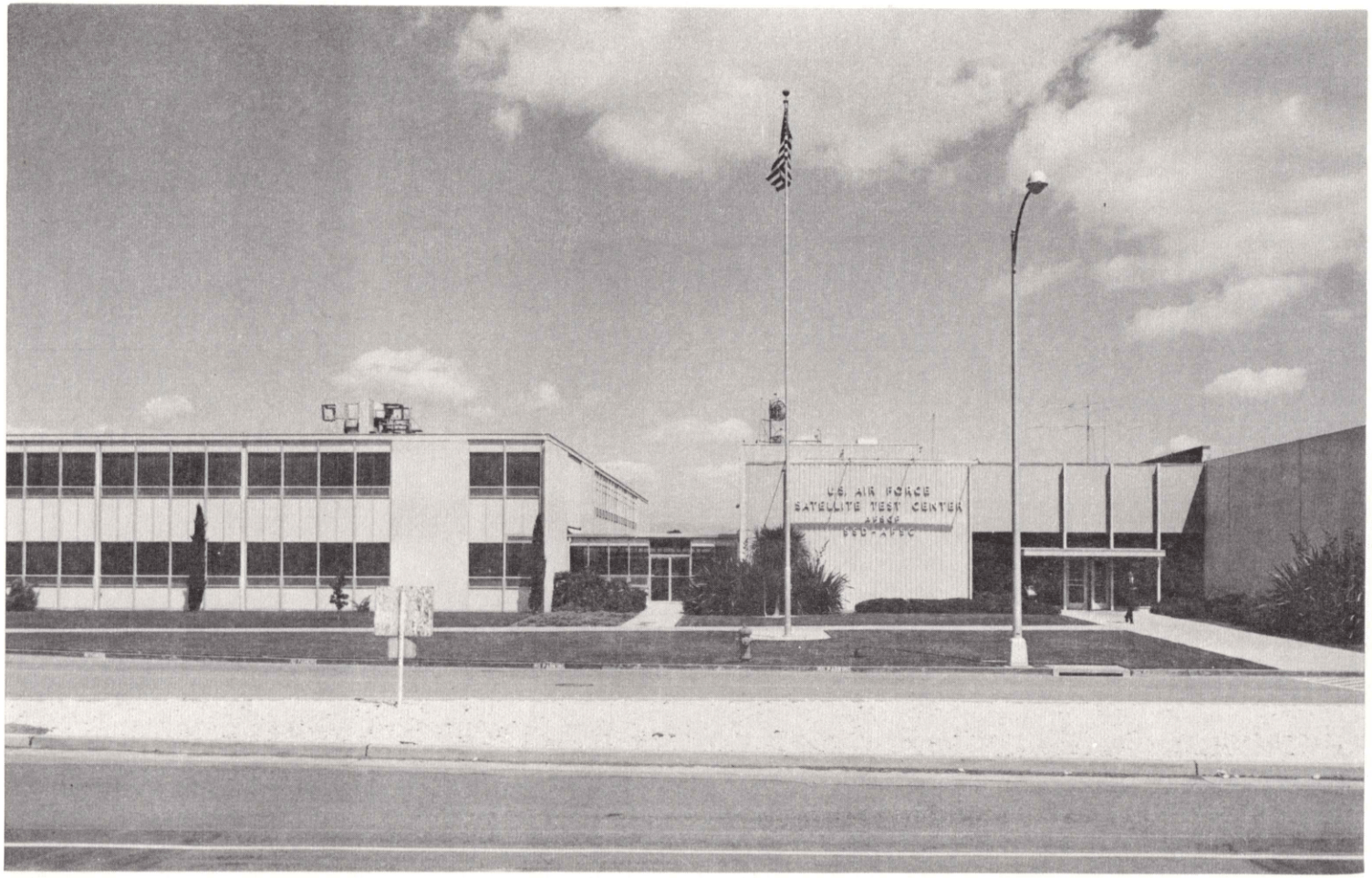
TYPICAL CAPSULE RECOVERY SEQUENCE



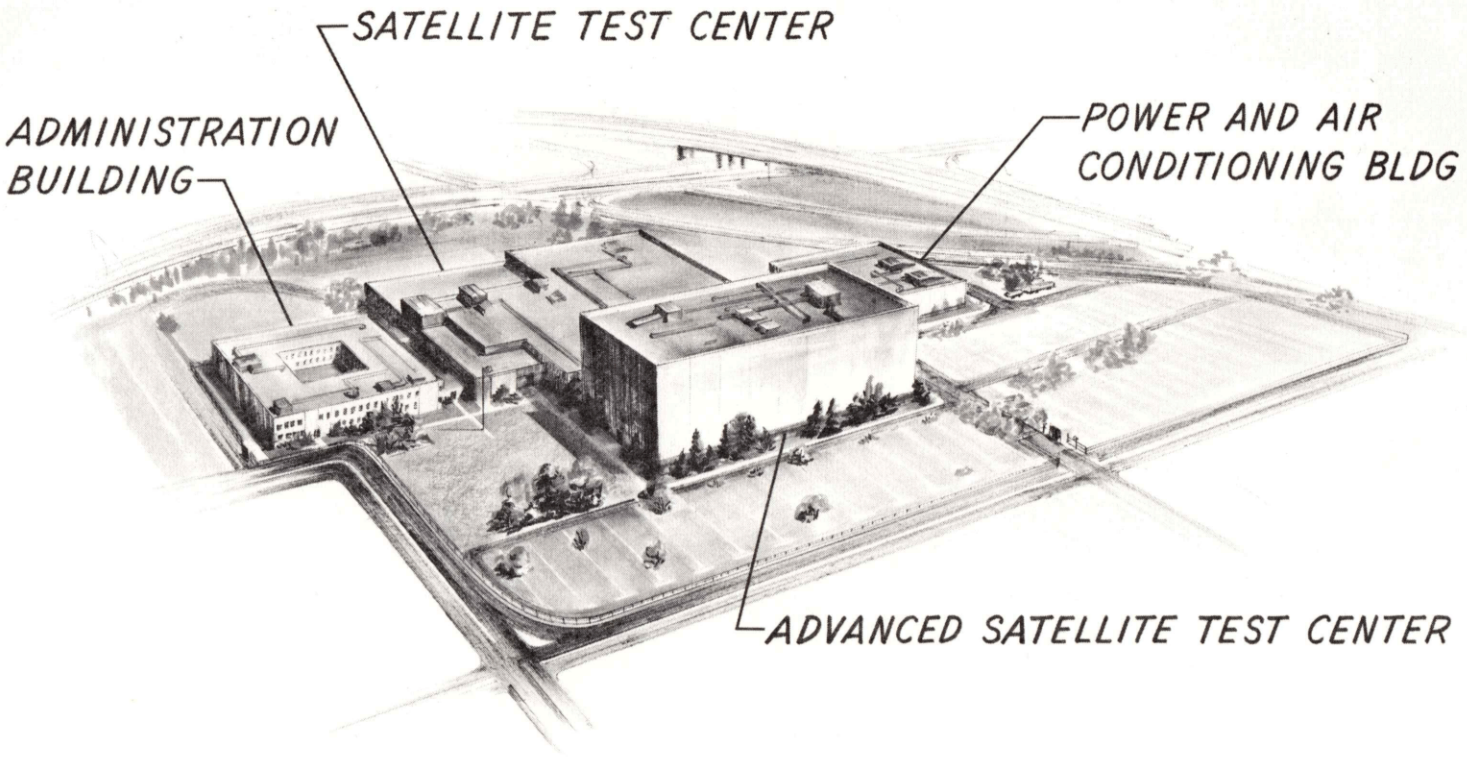
RECOVERY CONTROL CENTER



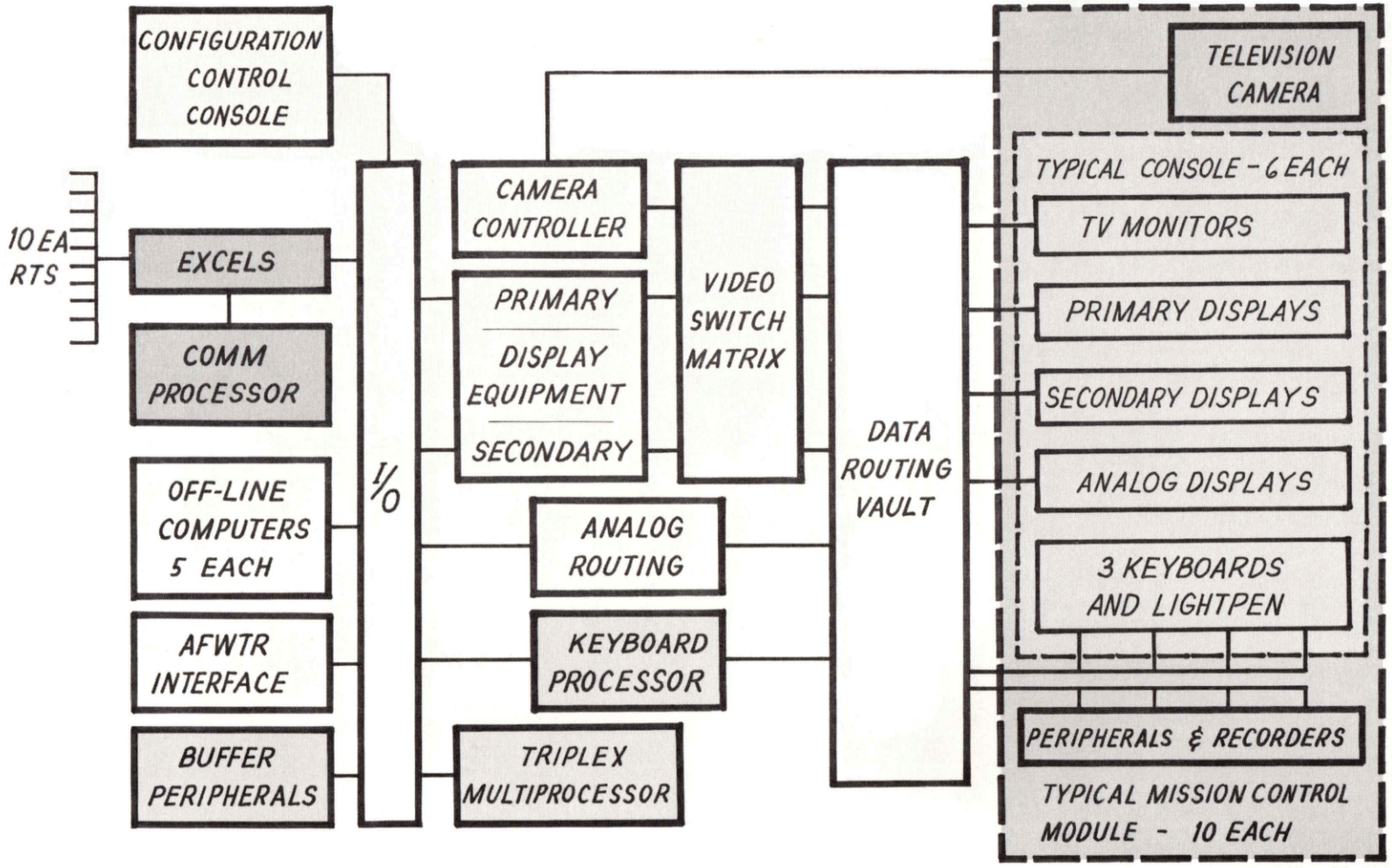
SATELLITE TEST CENTER

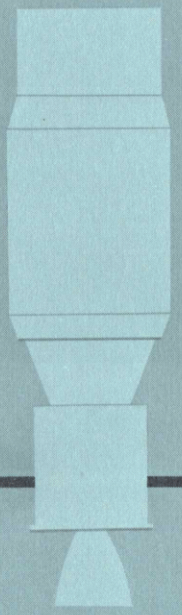


ADVANCED DATA SYSTEM EXPANSION



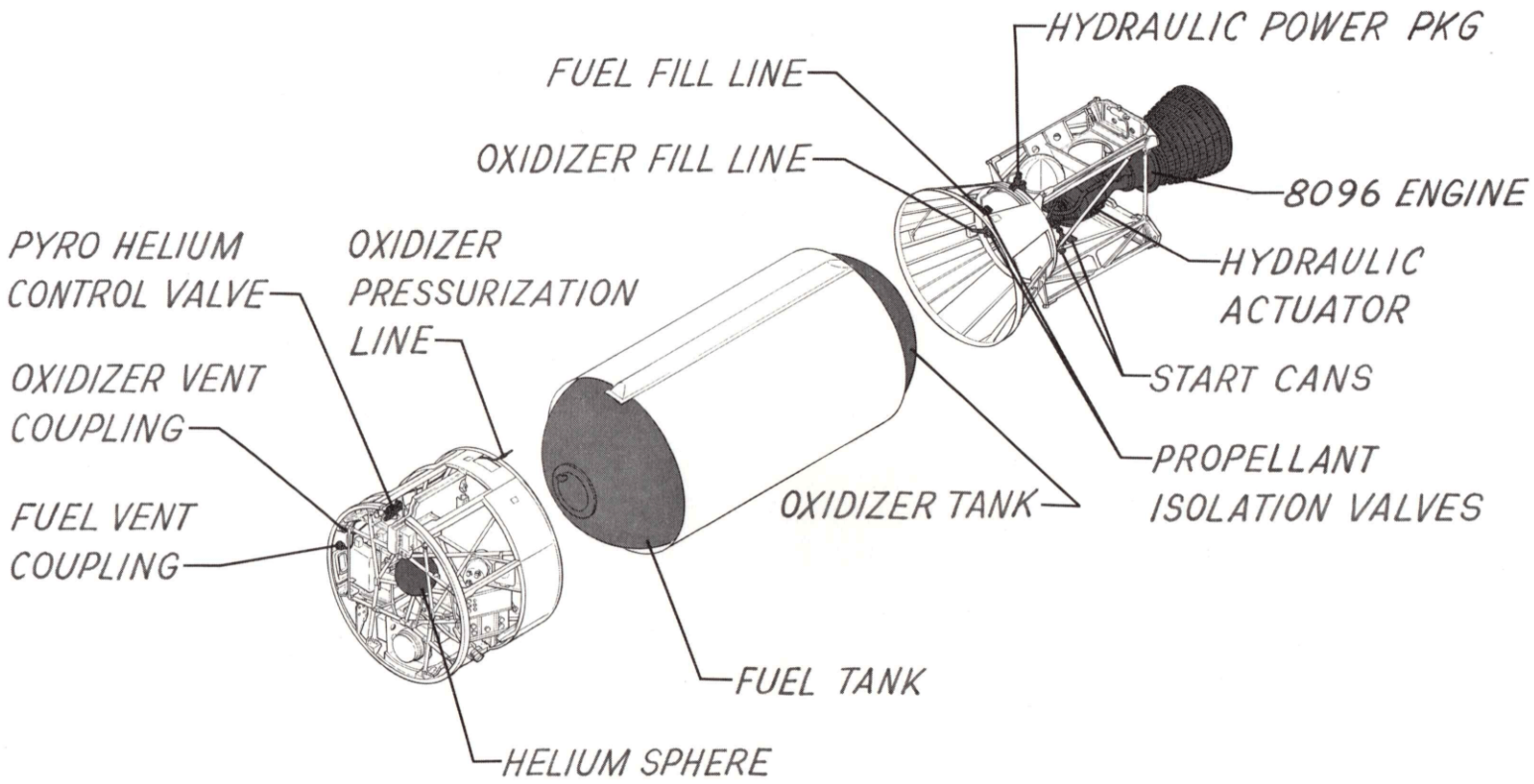
STC-ADS EQUIPMENT



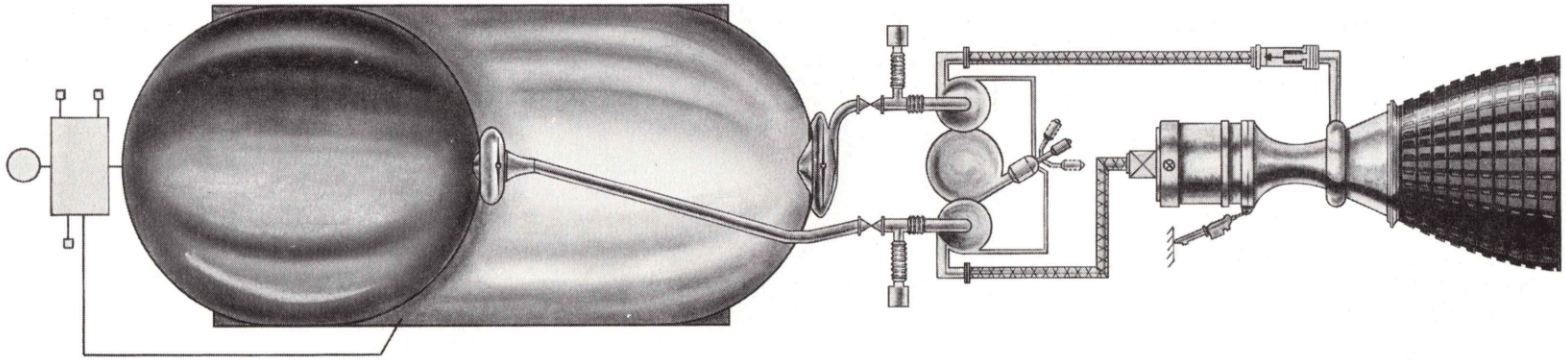


PROPULSION

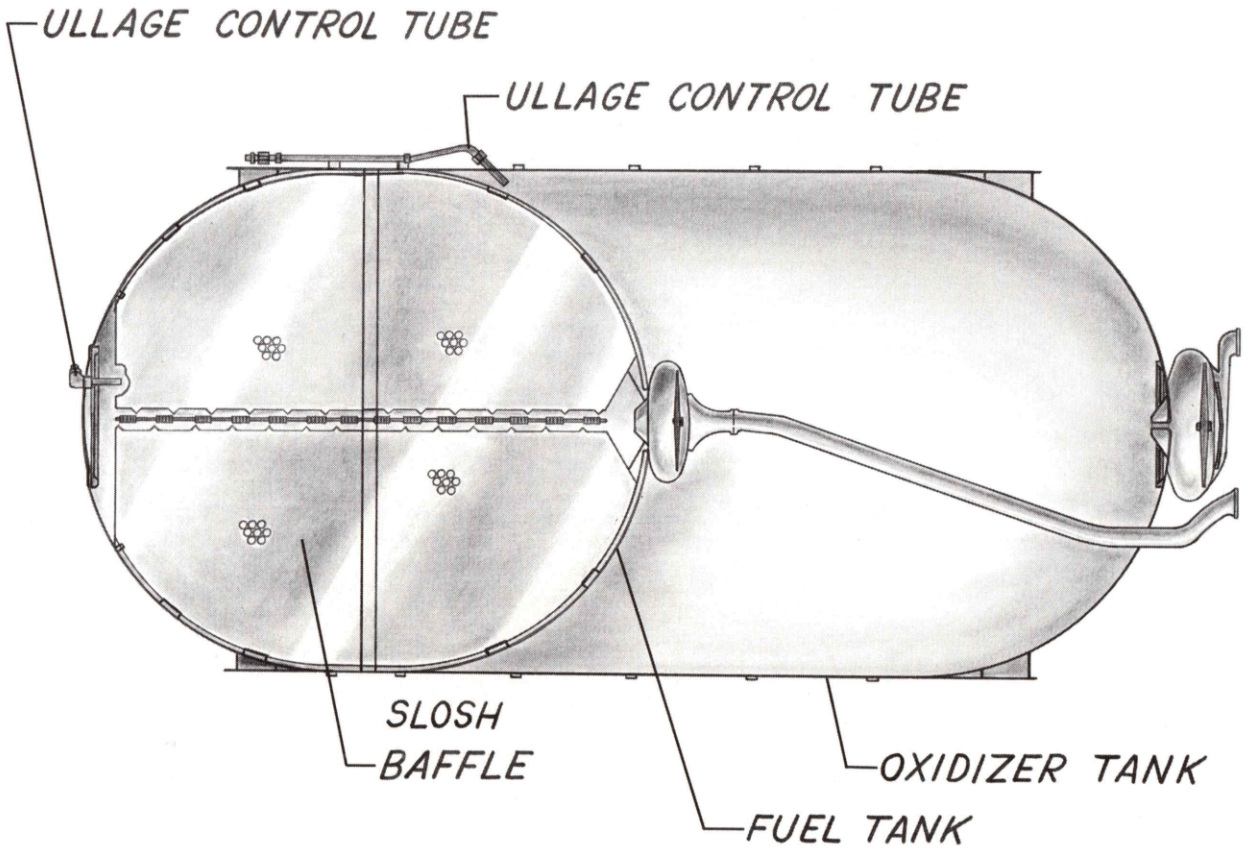
PROPULSION


HYDRAULIC POWER PKG
FUEL FILL LINE
OXIDIZER FILL LINE
8096 ENGINE
PYRO HELIUM CONTROL VALVE
OXIDIZER PRESSURIZATION LINE
HYDRAULIC ACTUATOR
START CANS
OXIDIZER VENT COUPLING
PROPELLANT ISOLATION VALVES
FUEL VENT COUPLING
OXIDIZER TANK
FUEL TANK
HELIUM SPHERE

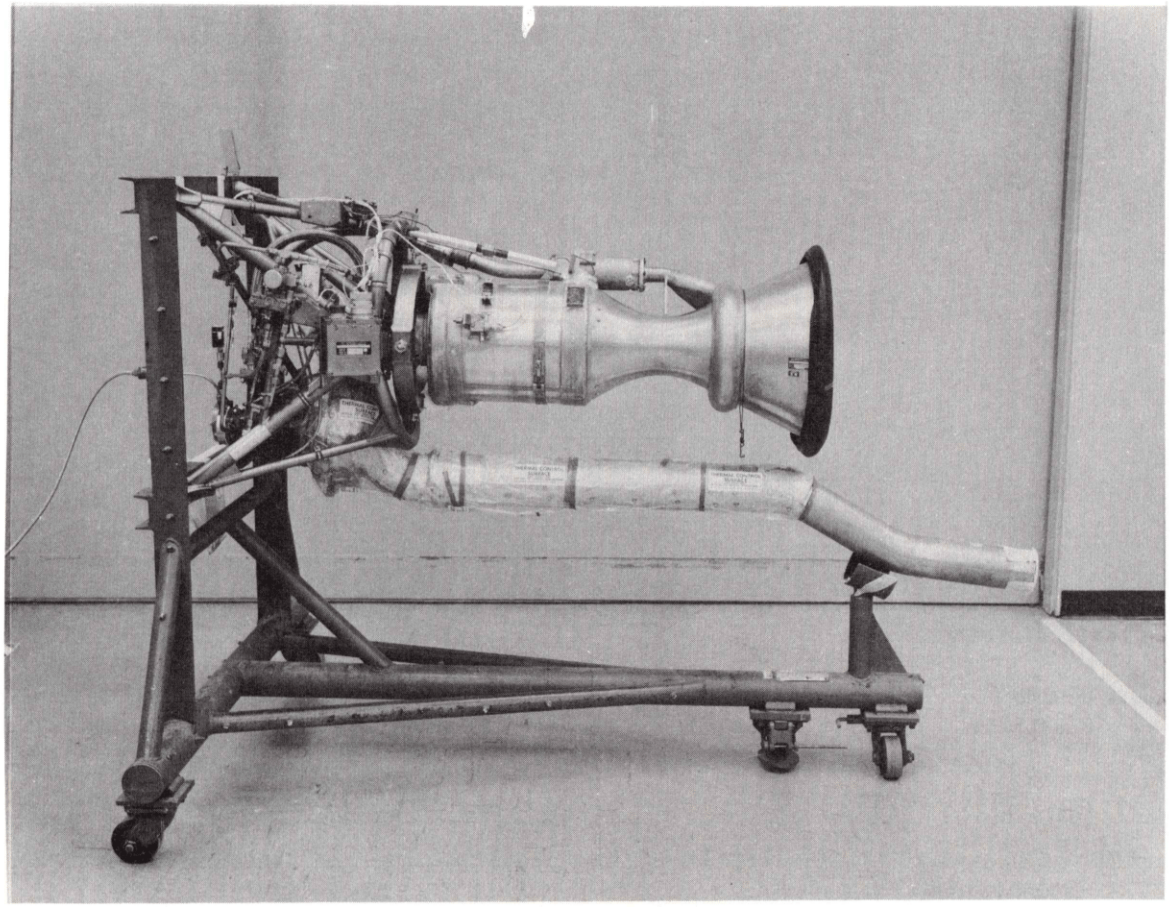
AGENA PROPULSION SYSTEM



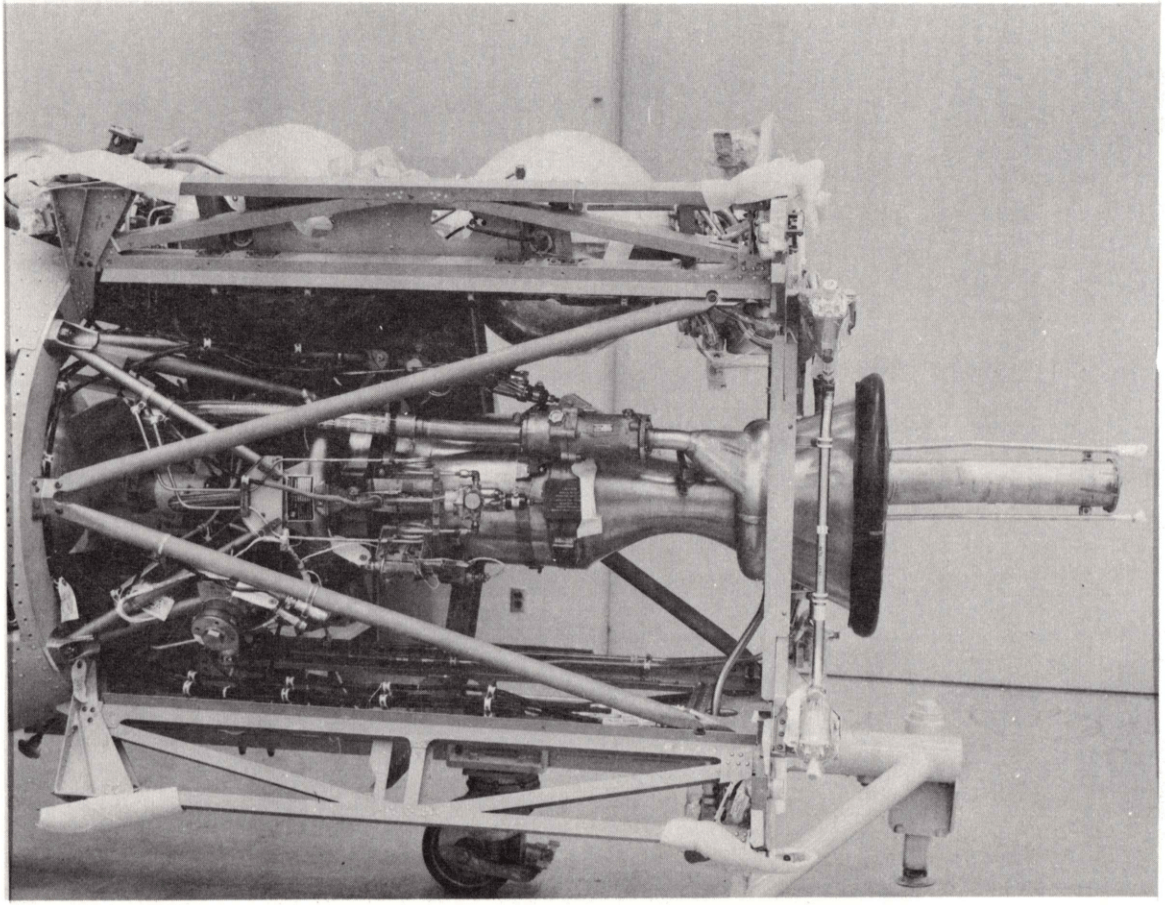
TANK SECTION



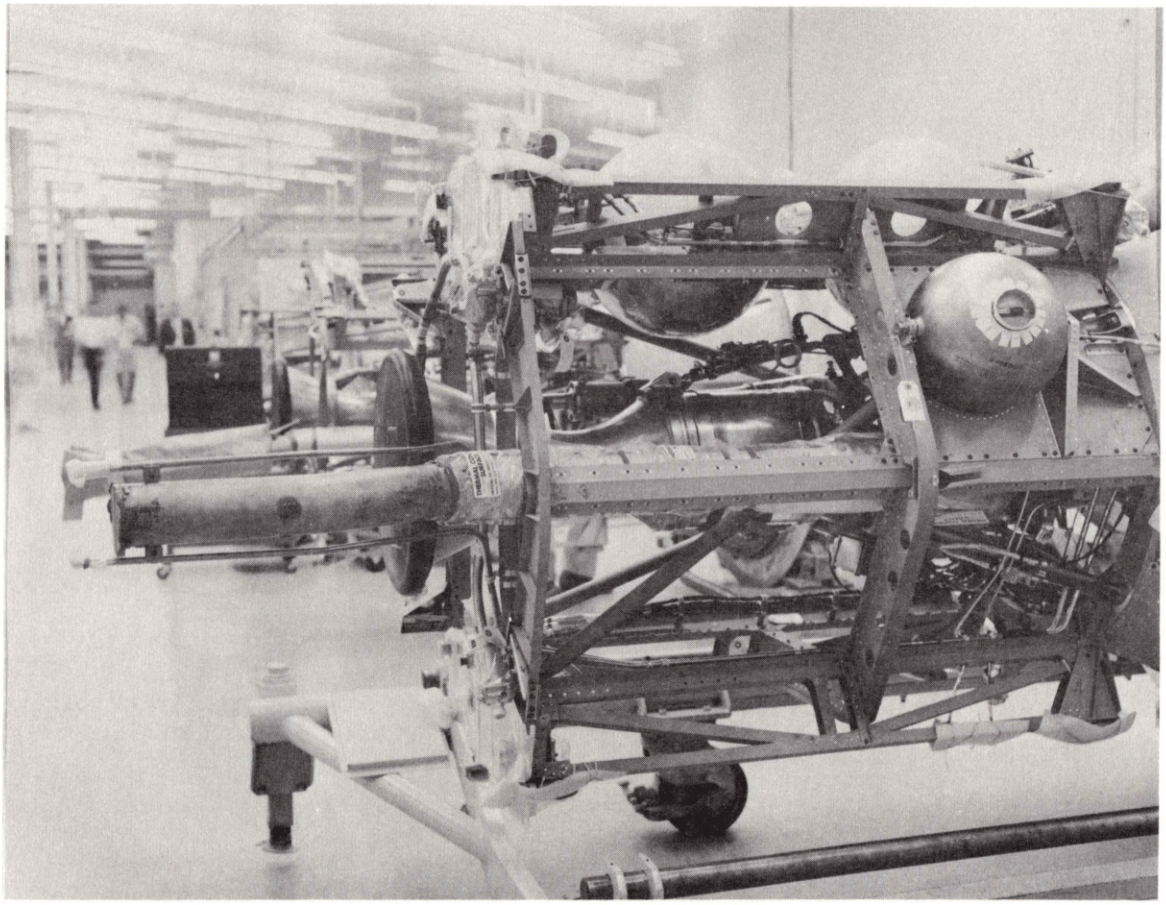
BELL ENGINE +Z AXIS



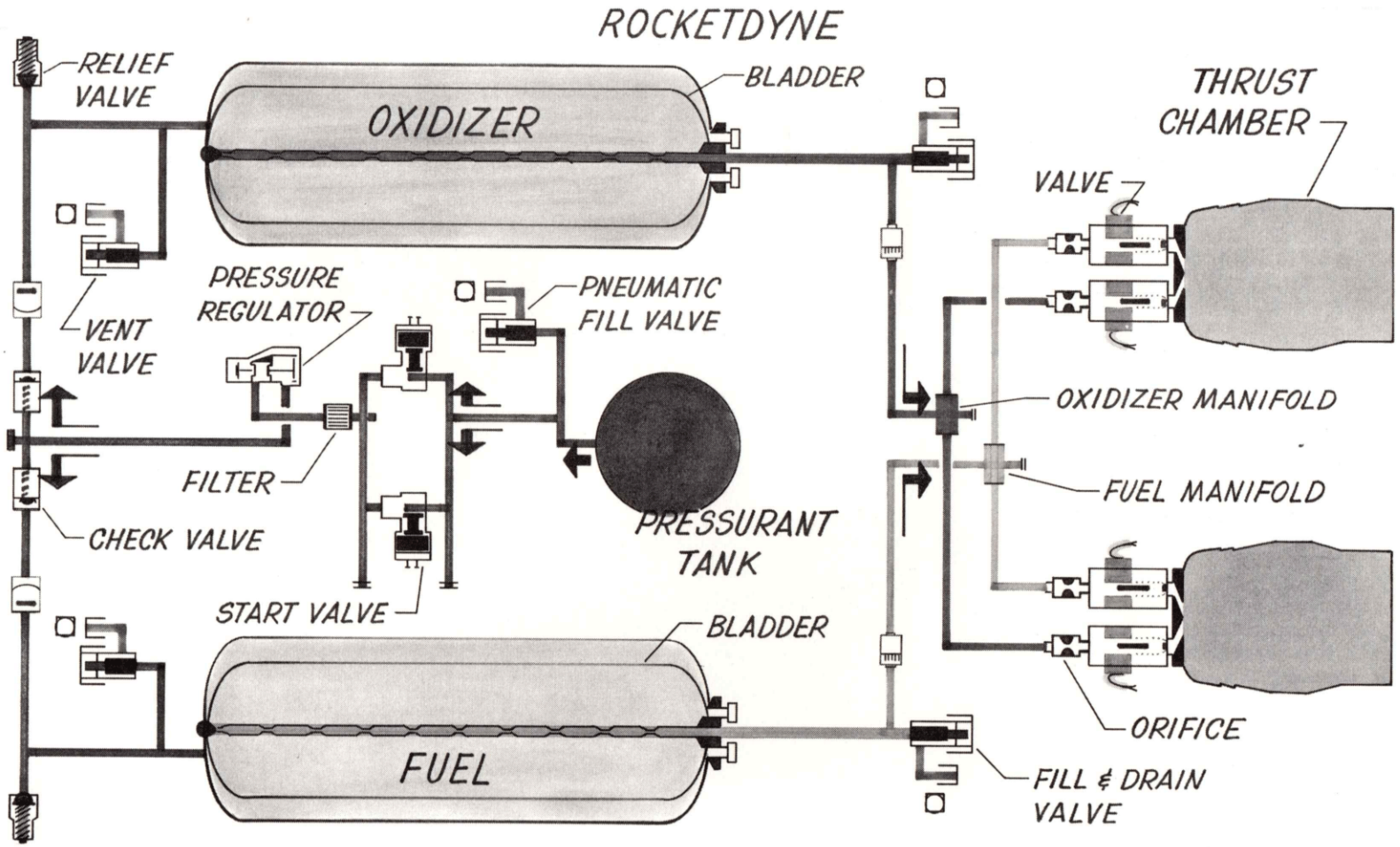
BELL ENGINE INSTALLED -Y AXIS



BELL ENGINE INSTALLED +Y AXIS

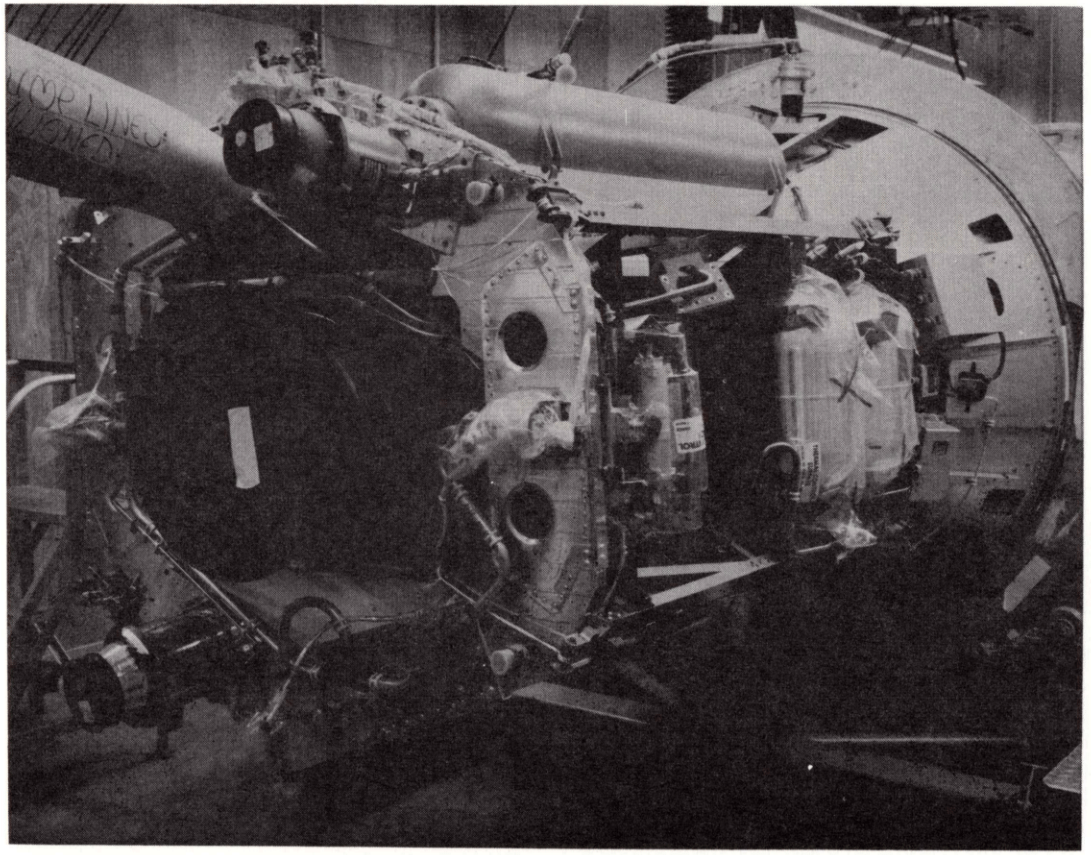


SECONDARY PROPULSION SYSTEM

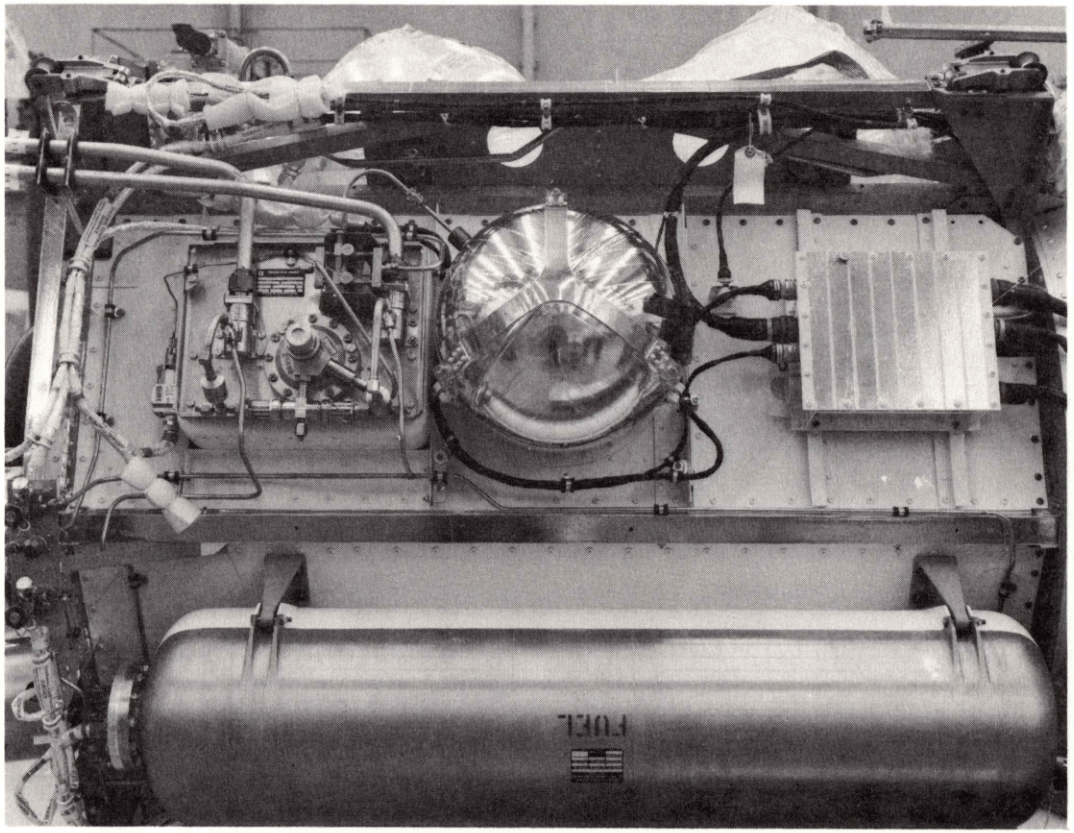


ROCKETDYNE SECONDARY PROPULSION SYS.

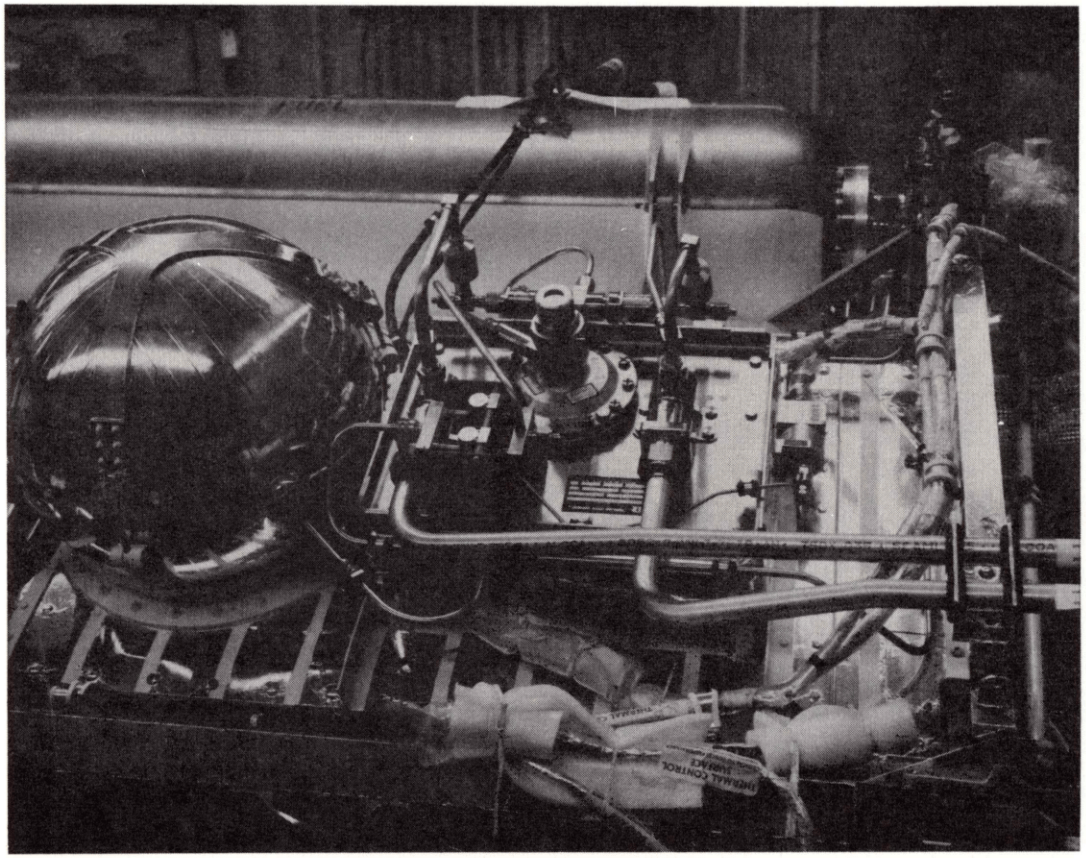
MOUNTED ON VEHICLE AFT SECTION



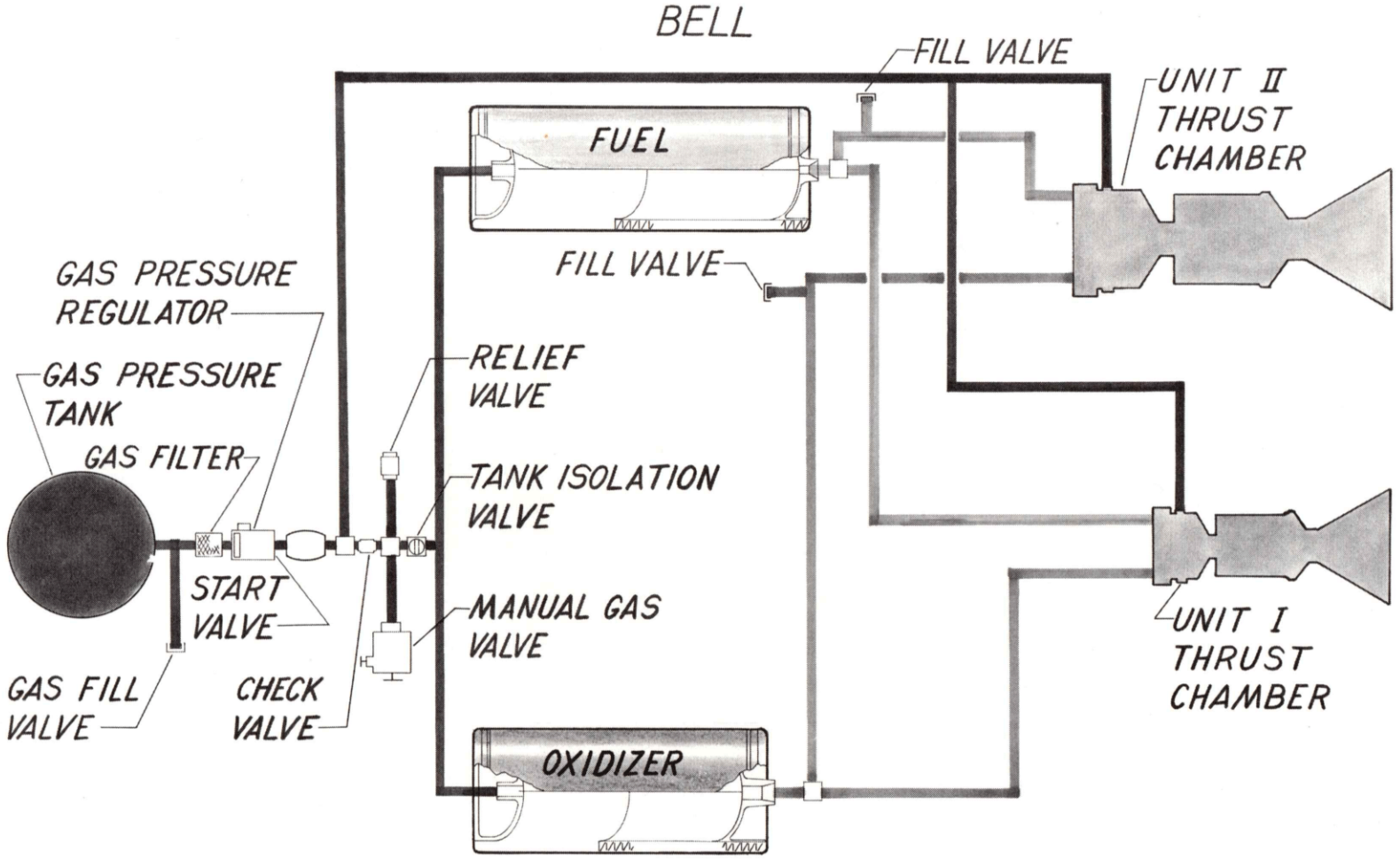
ROCKETDYNE SPS "B" MODULE



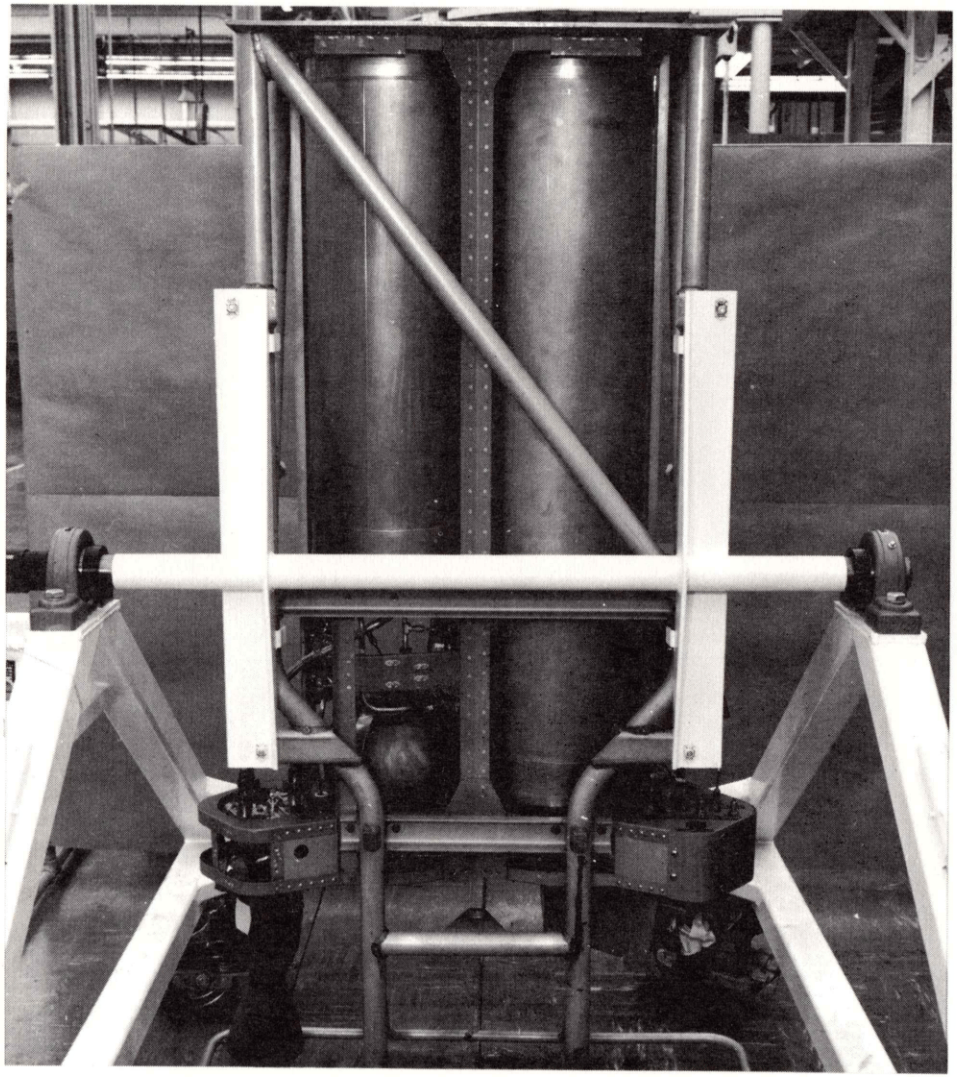
ROCKETDYNE SPS PNEUMATIC CONTROL



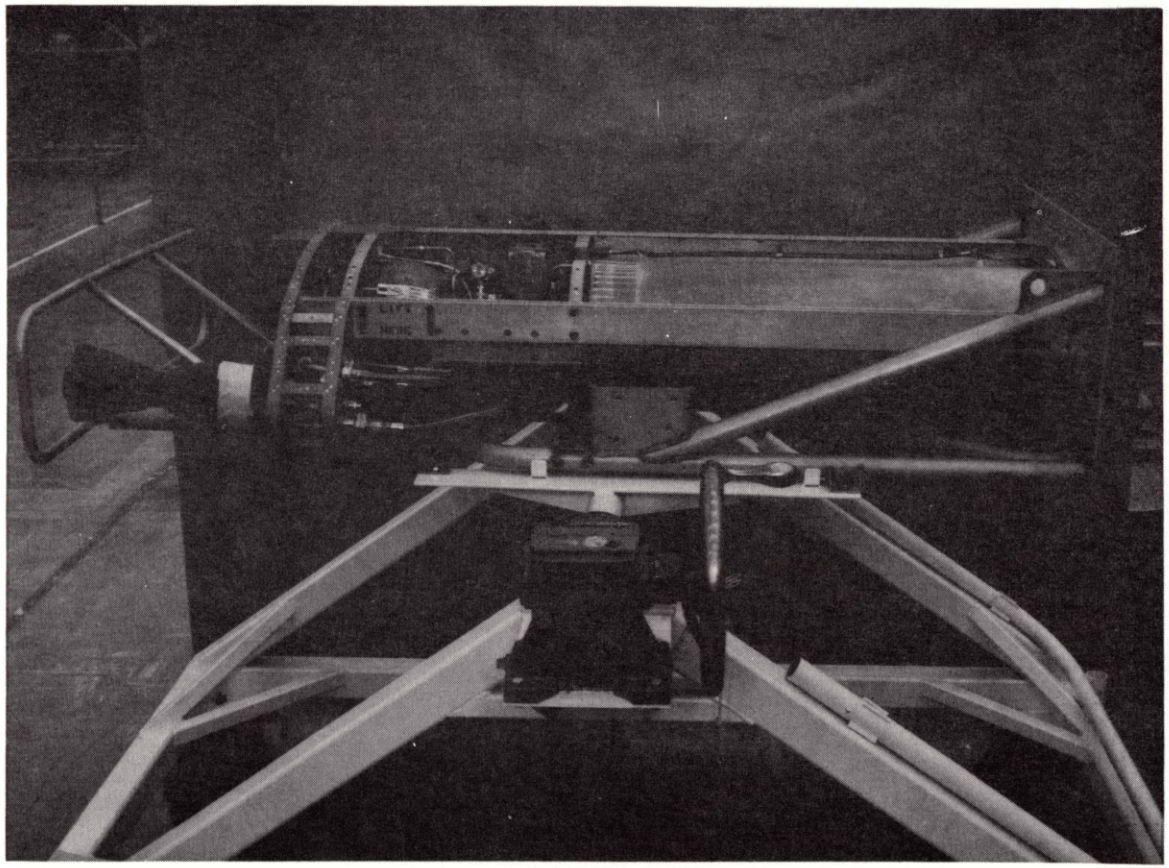
SECONDARY PROPULSION SYSTEM



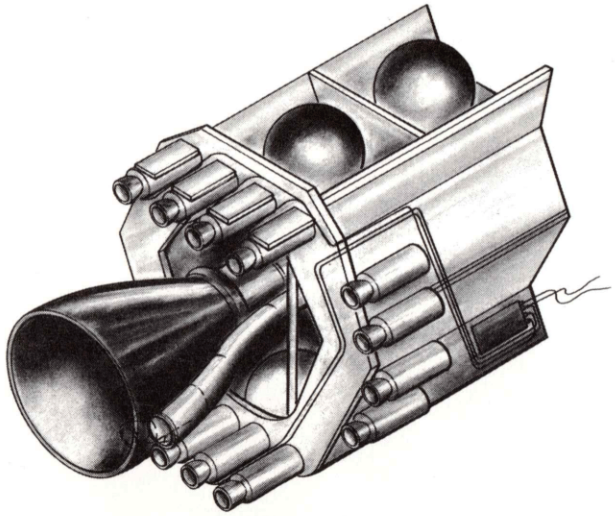
BELL SECONDARY PROPULSION SYSTEM

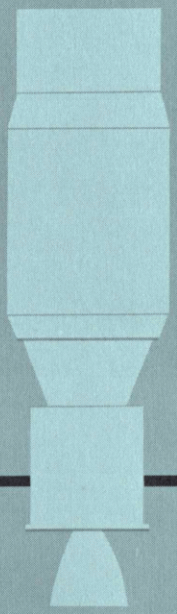


BELL SPS IN HANDLING DOLLY



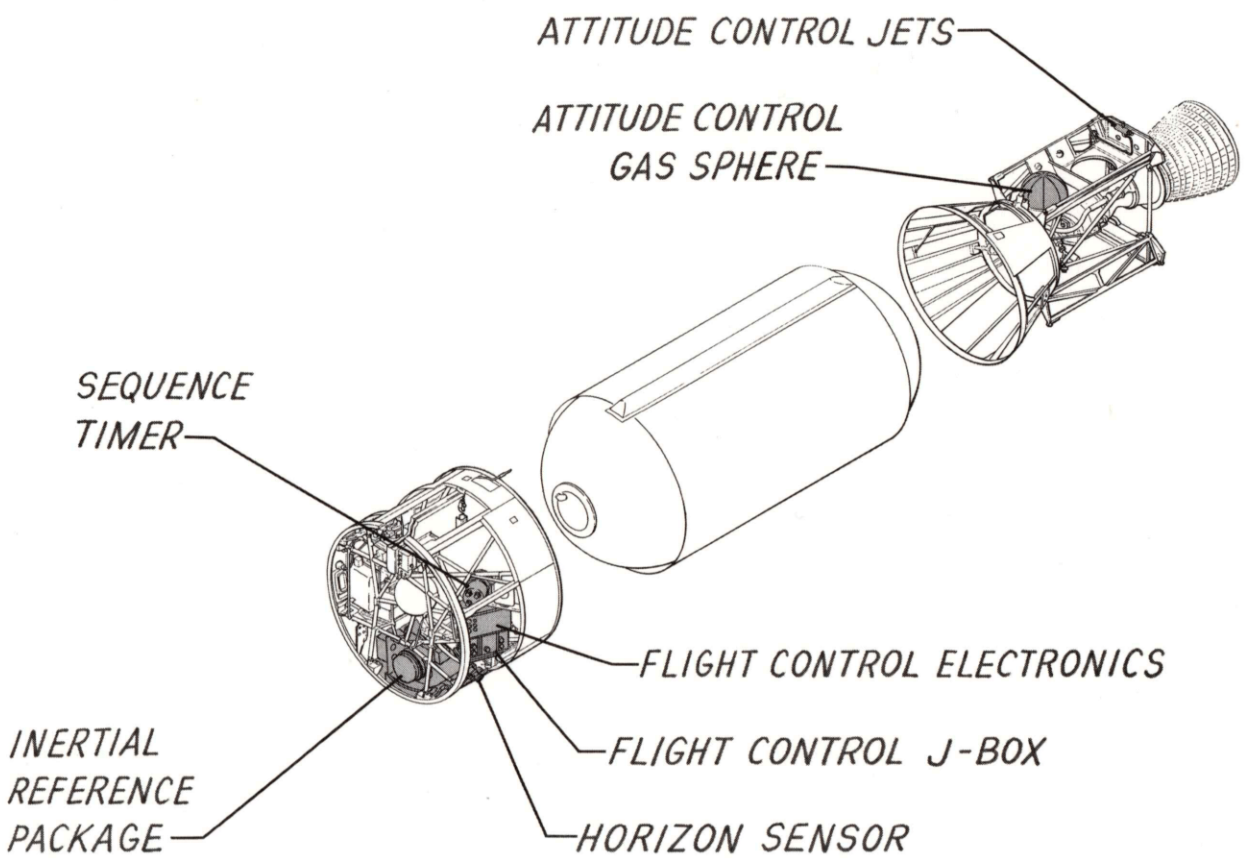
AUXILIARY PROPULSION CAPABILITY



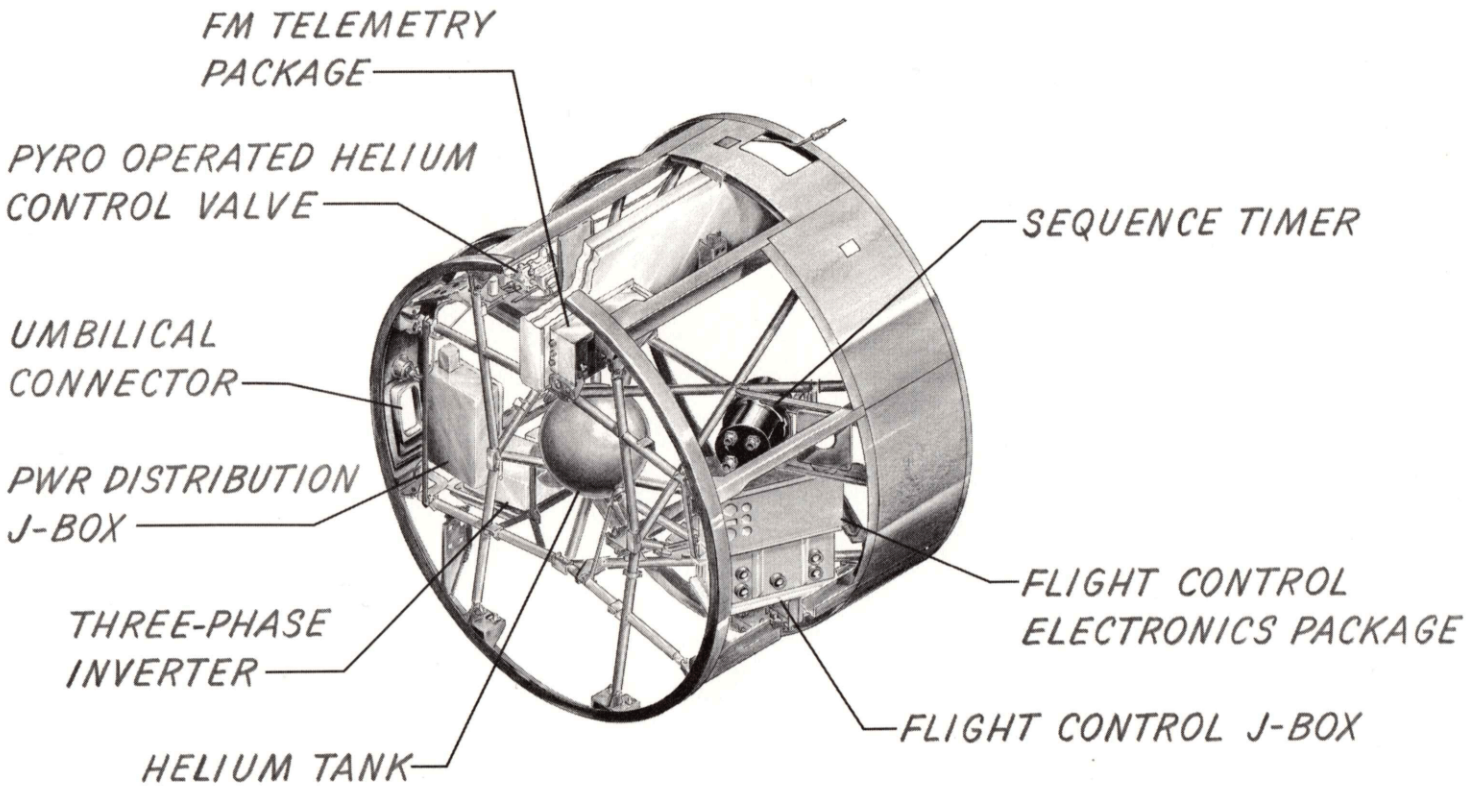


GUIDANCE AND CONTROL

GUIDANCE & CONTROL



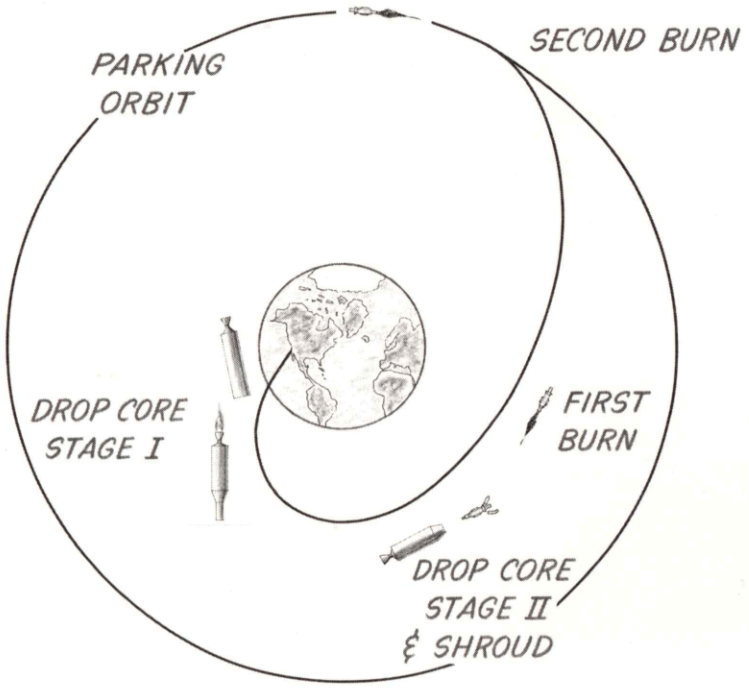
FORWARD SECTION - BASIC CONFIG



LAUNCH VEHICLE ASCENT SEQUENCE

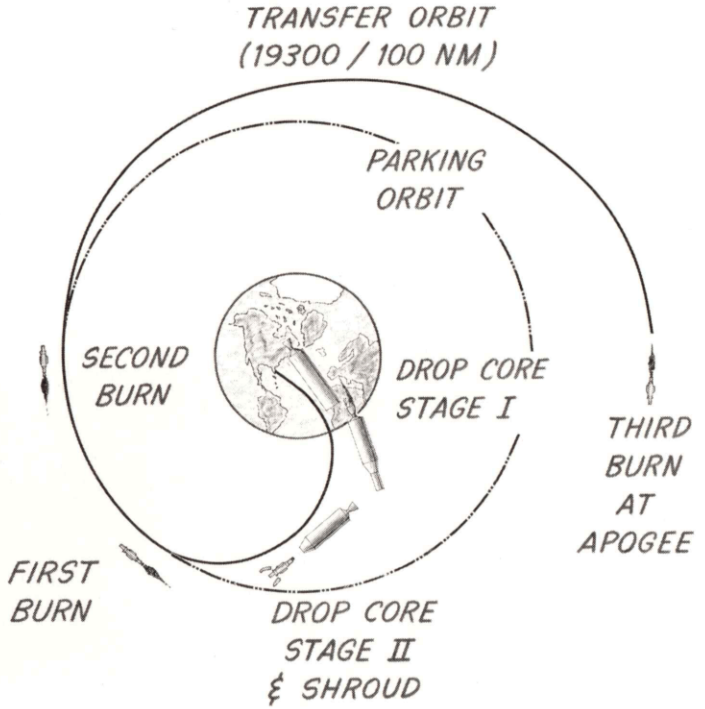
AGENA DUAL-BURN INJECTION

SLV-5B BOOSTER
WTR-INTERMEDIATE ORBIT

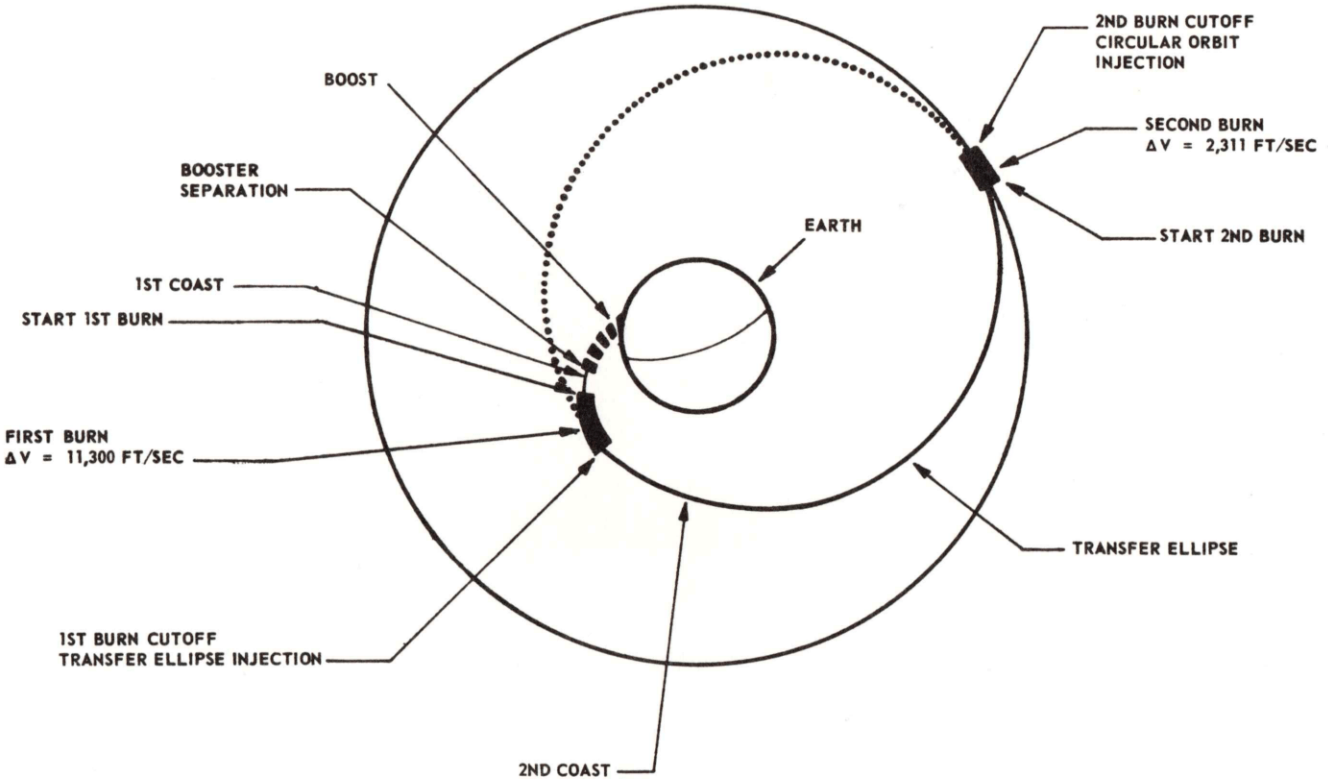


AGENA TRIPLE-BURN INJECTION

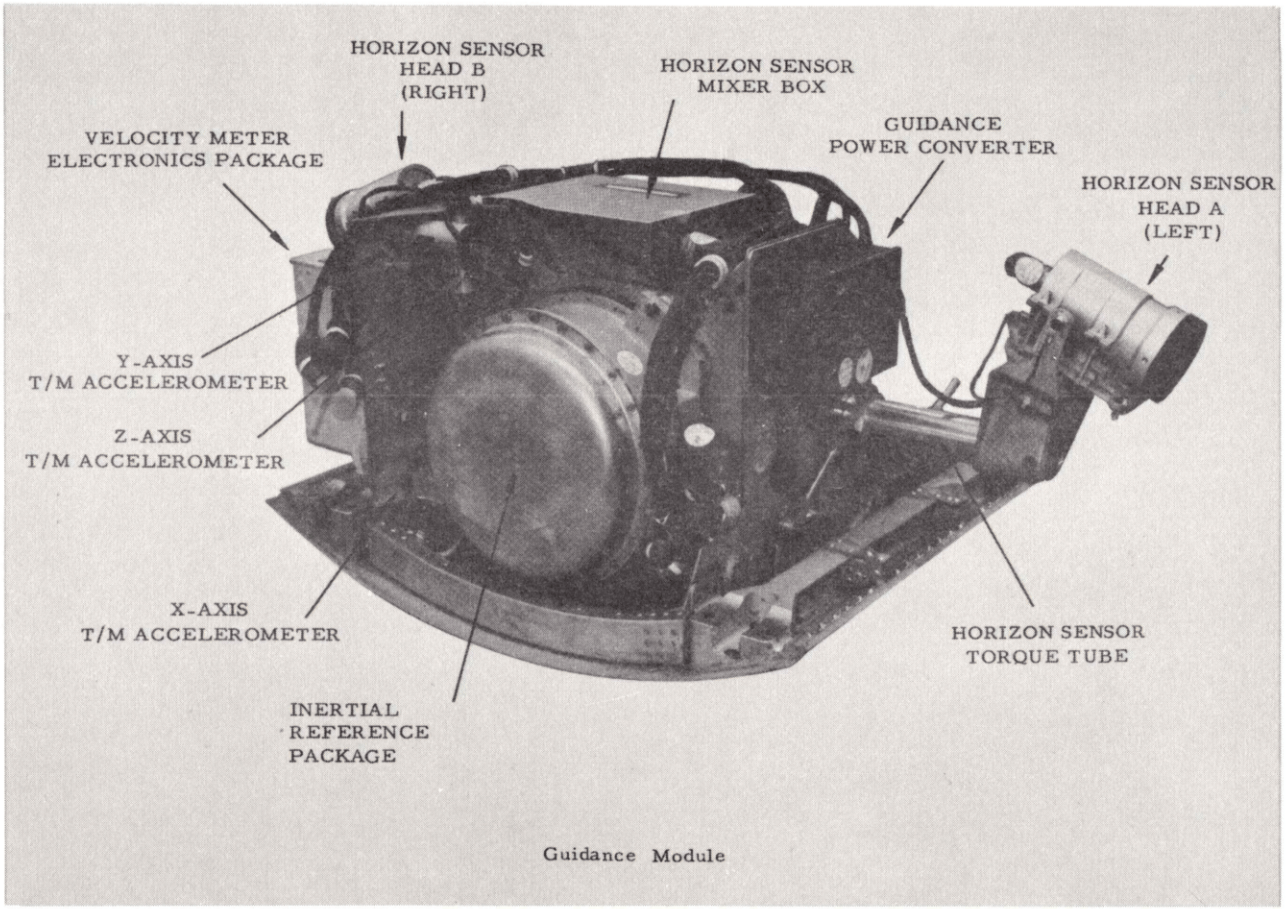
SLV-5B BOOSTER
ETR-SYNCHRONOUS ORBIT



ASCENT FLIGHT MECHANICS



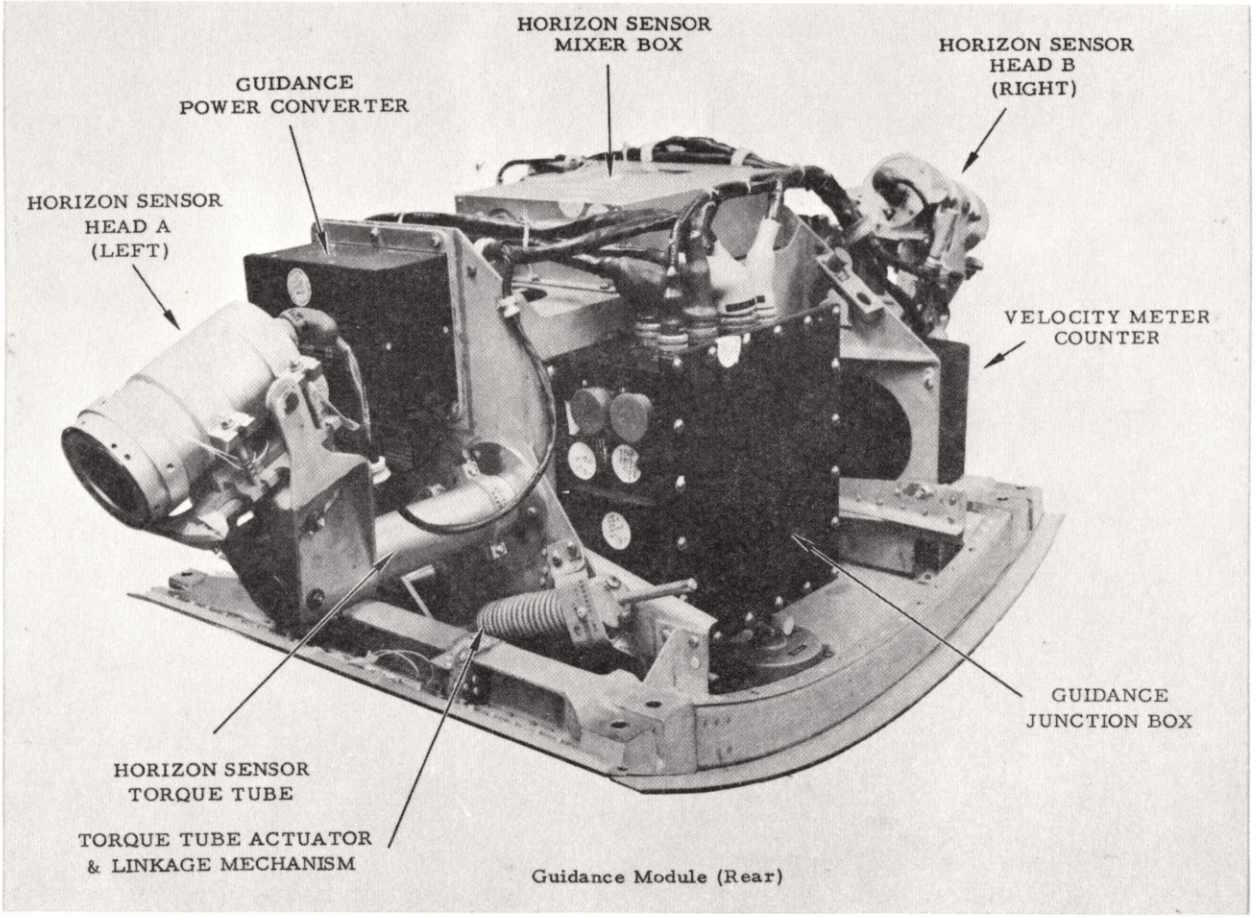
GUIDANCE MODULE



Guidance Module

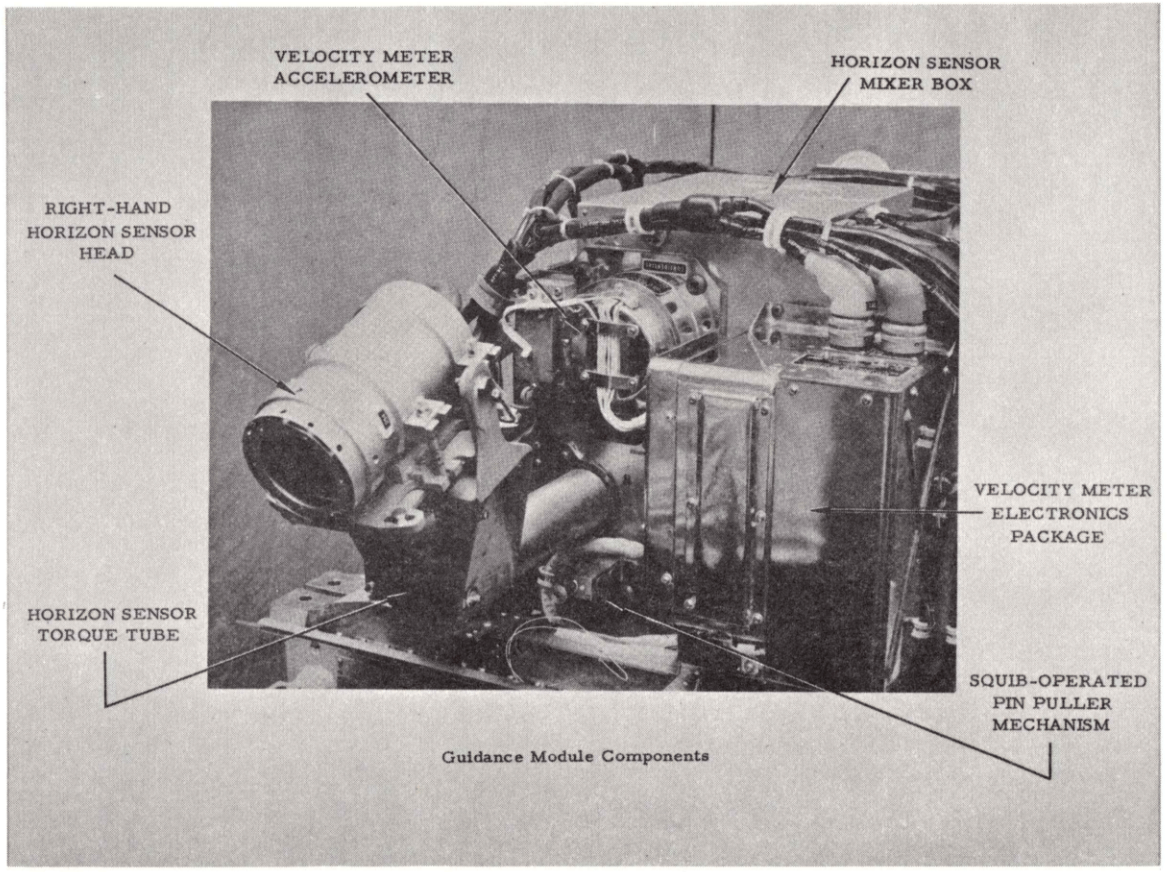
GUIDANCE MODULE

REAR



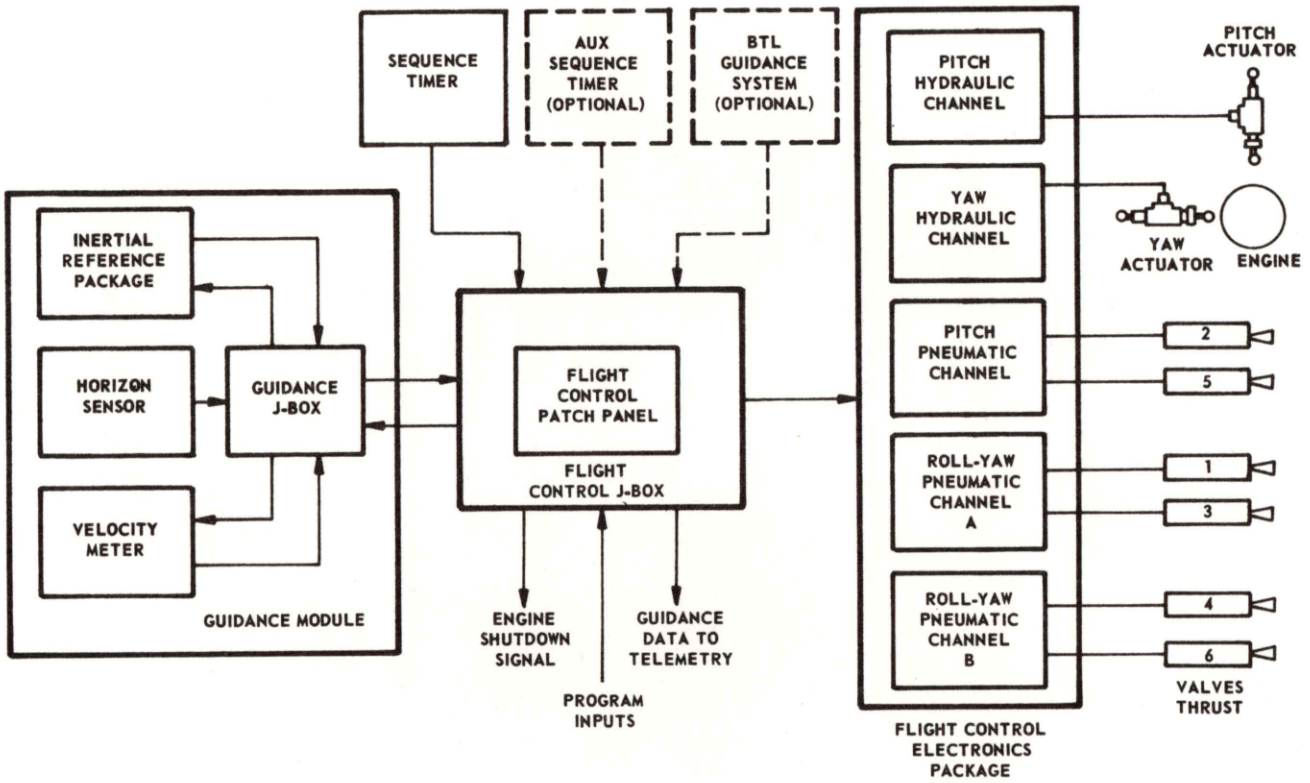
Guidance Module (Rear)

GUIDANCE MODULE COMPONENTS

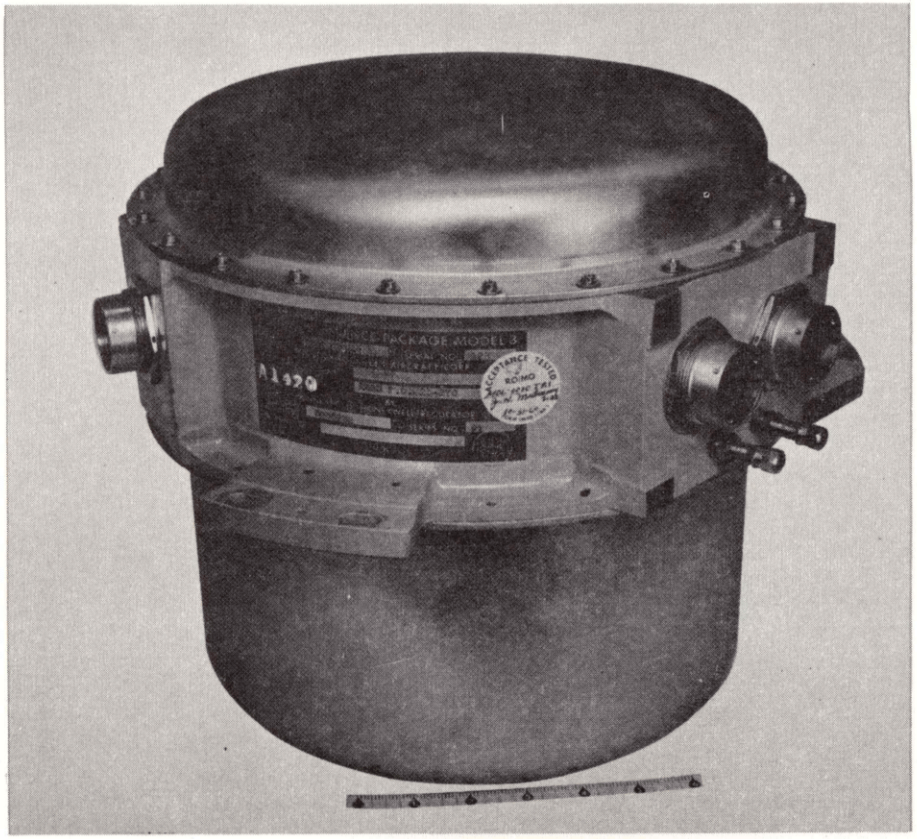


Guidance Module Components

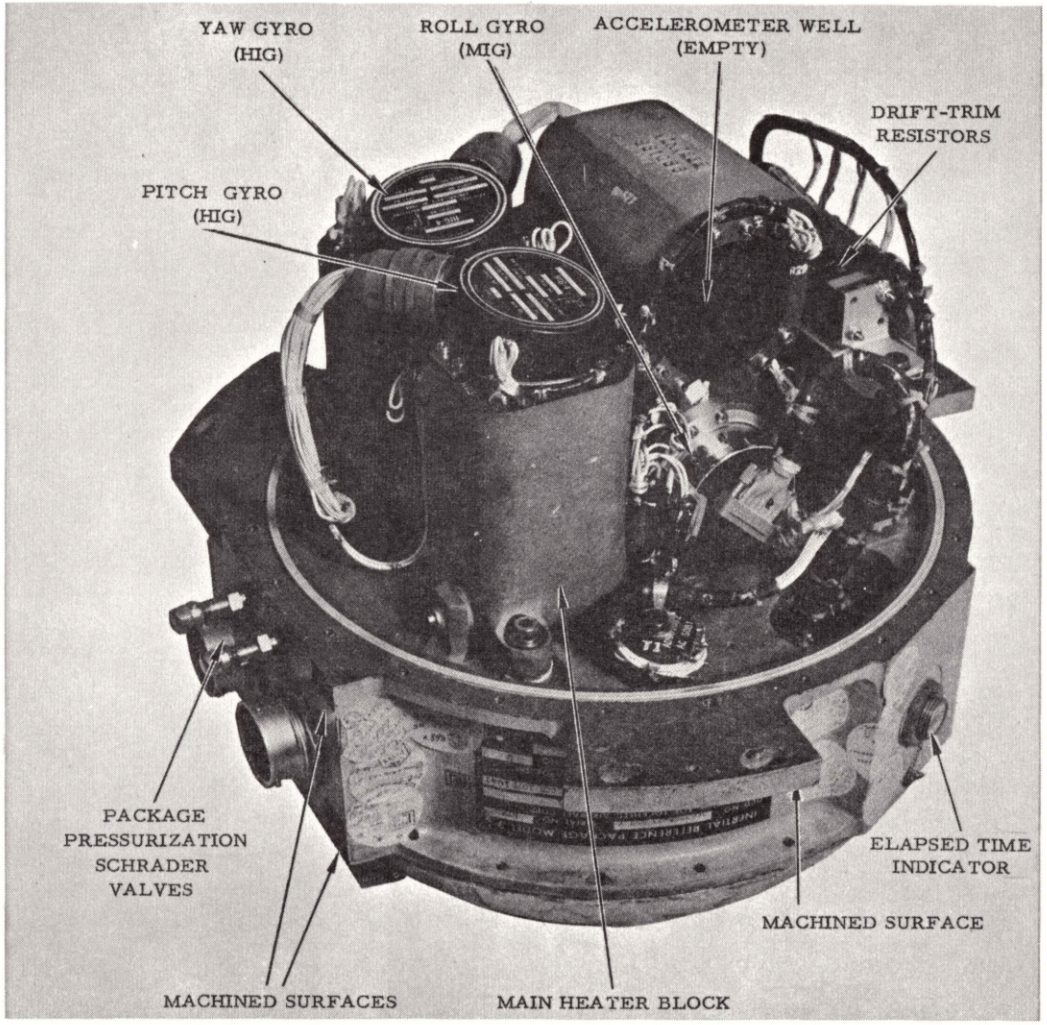
GUIDANCE AND CONTROL SYSTEM DIAGRAM



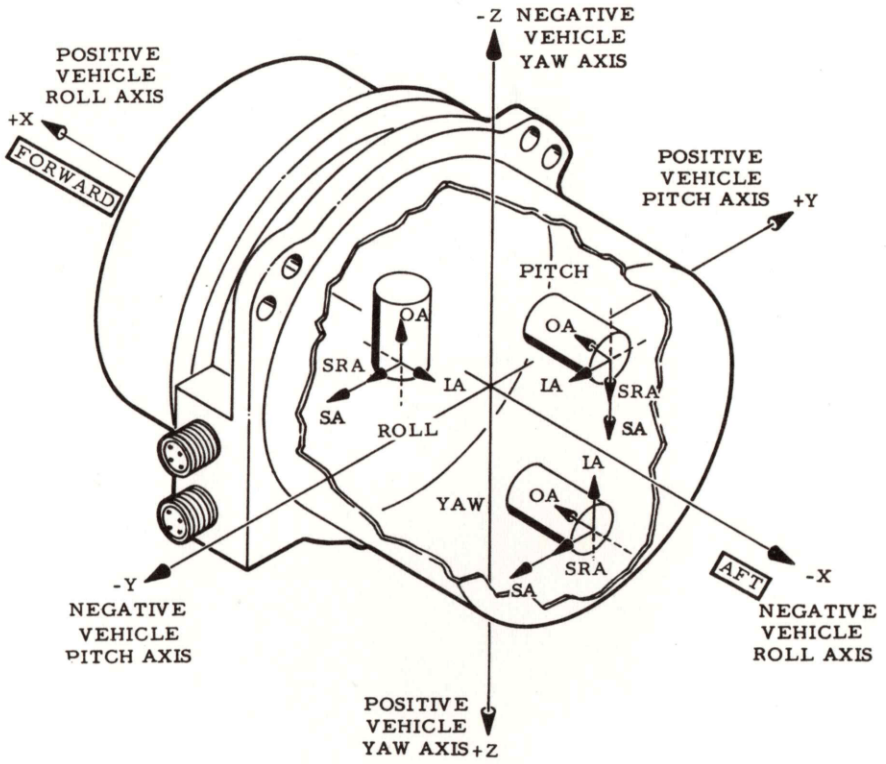
INERTIAL REFERENCE PACKAGE (IRP)



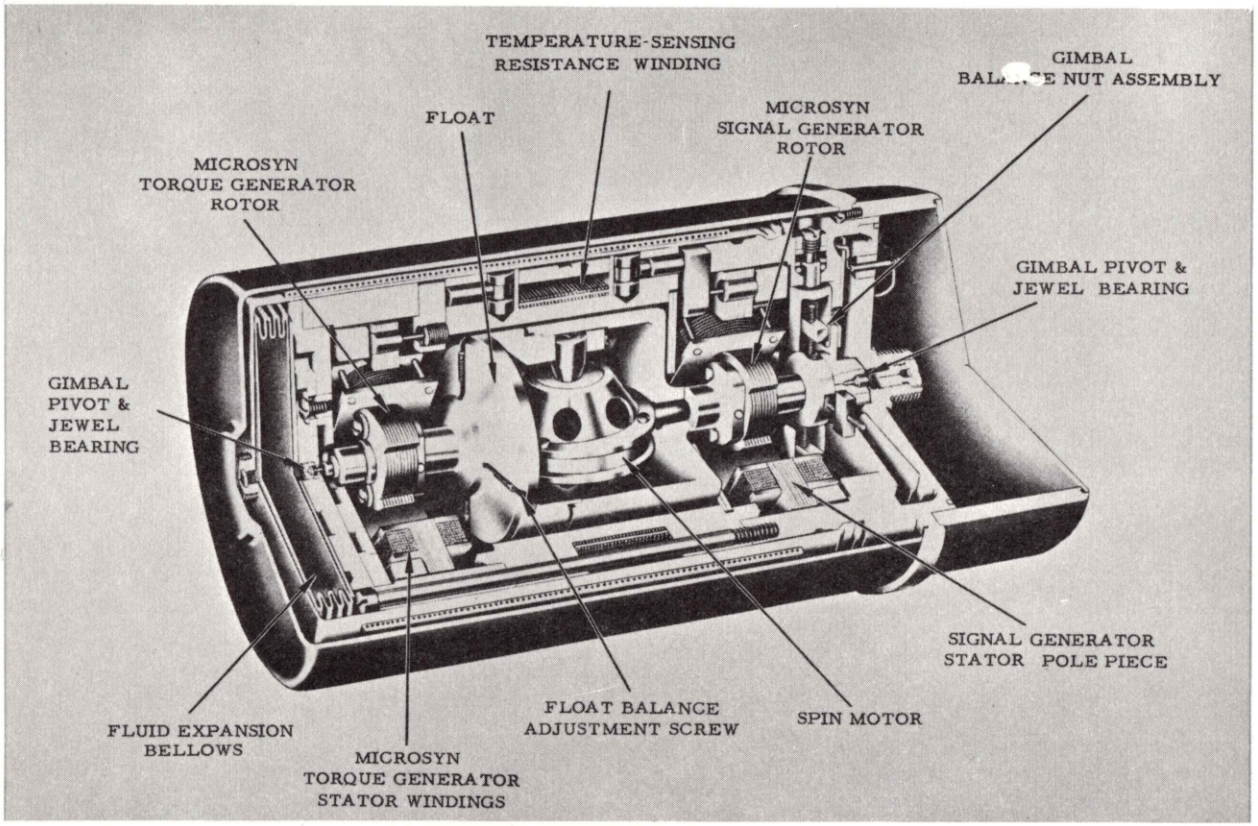
IRP – COVER REMOVED



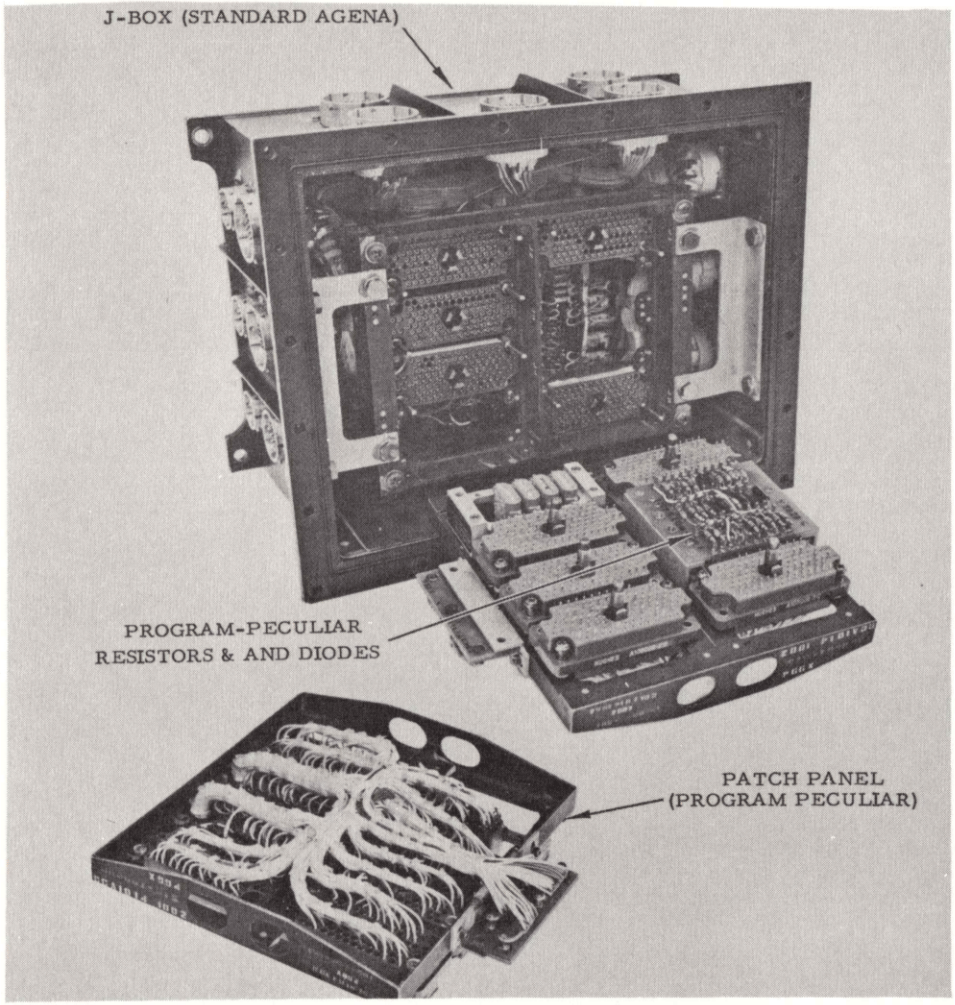
IRP-GYRO ORIENTATION



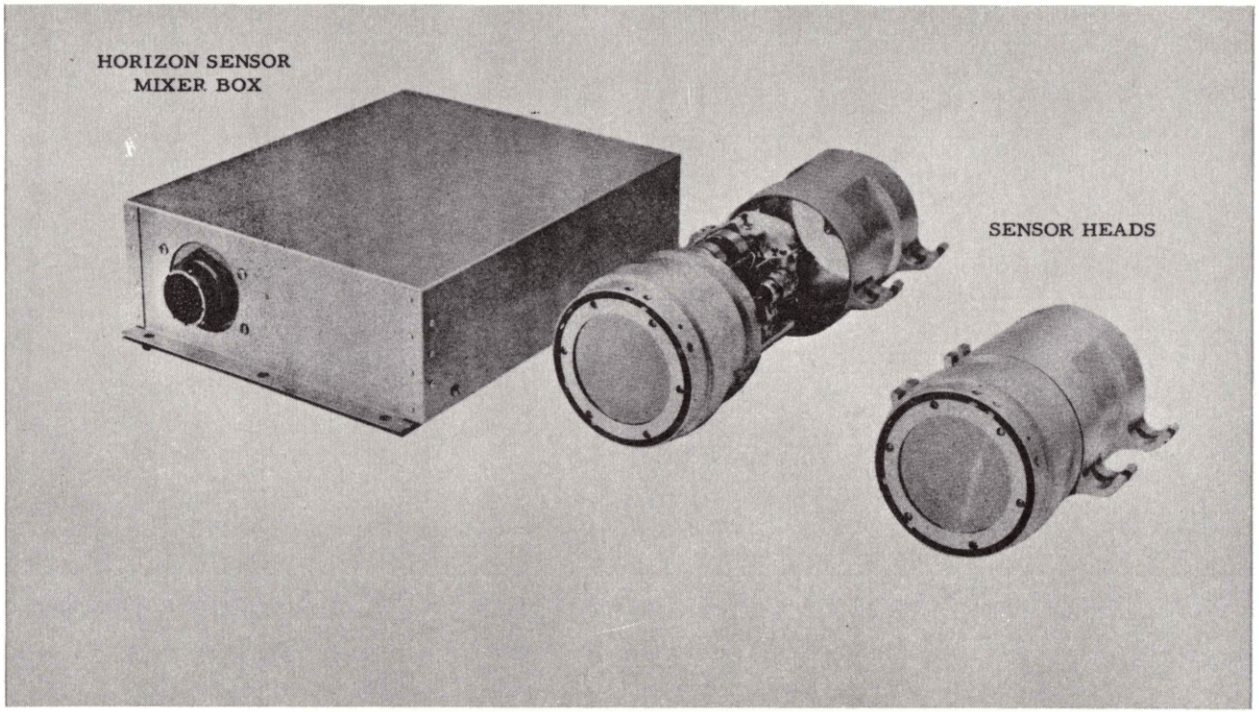
HIG GYRO


TEMPERATURE-SENSING
RESISTANCE WINDING
GIMBAL
BALANCE NUT ASSEMBLY
FLOAT
MICROSYN
SIGNAL GENERATOR
ROTOR
MICROSYN
TORQUE GENERATOR
ROTOR
GIMBAL PIVOT &
JEWEL BEARING
GIMBAL
PIVOT &
JEWEL
BEARING
SIGNAL GENERATOR
STATOR POLE PIECE
FLUID EXPANSION
BELLOWS
MICROSYN
TORQUE GENERATOR
STATOR WINDINGS
FLOAT BALANCE
ADJUSTMENT SCREW
SPIN MOTOR

FLIGHT CONTROL J-BOX & PATCH PANEL

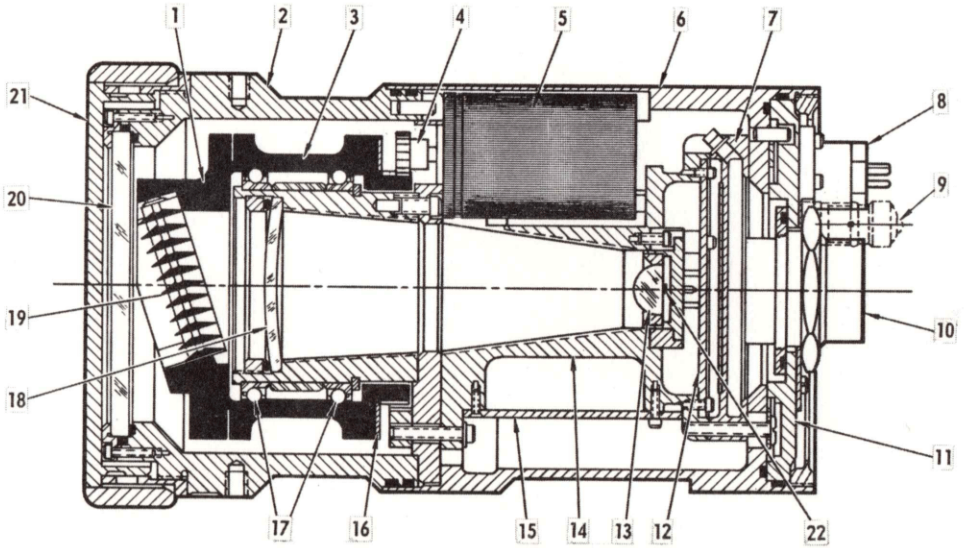


HORIZON SENSOR



SENSOR HEAD

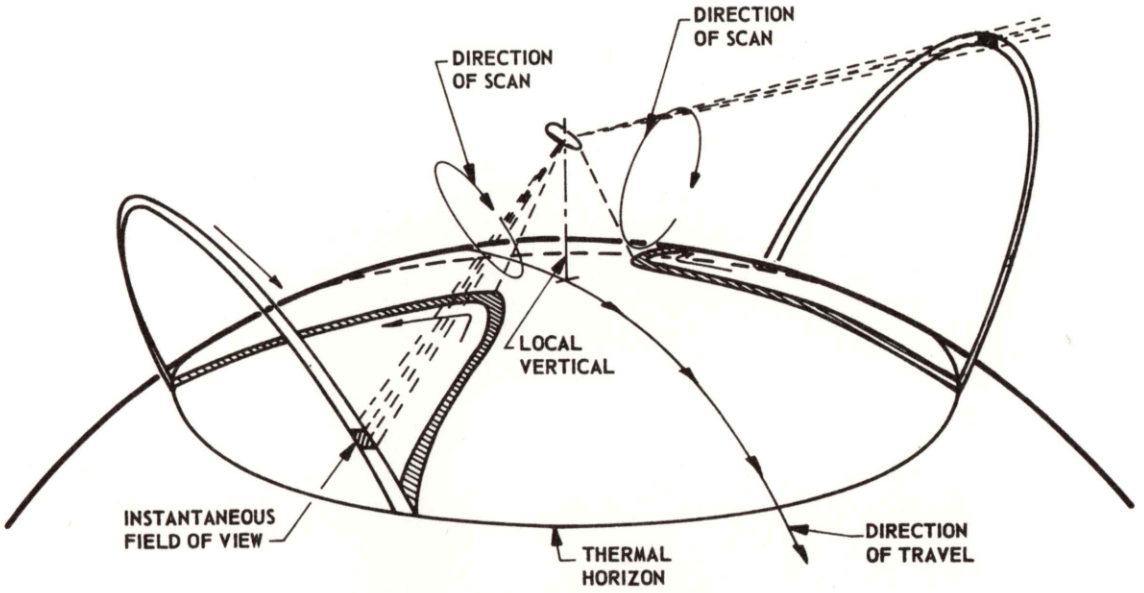
SECTION



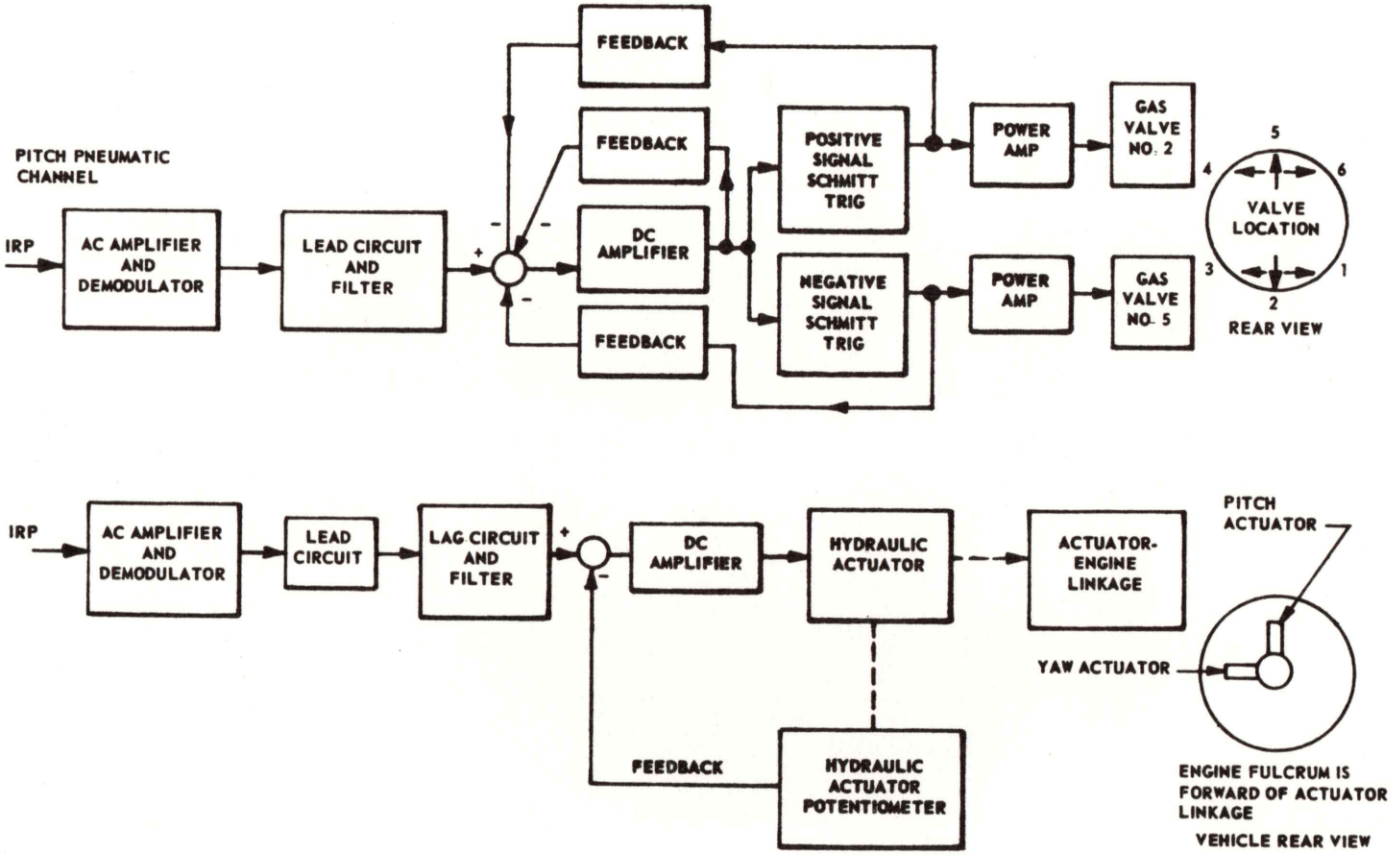
LEGEND:

1. MIRROR HOUSING
2. END CASE
3. BEARING HOUSING
4. SPUR GEAR
5. MOTOR
6. MOUNTING CASE
7. RFI SHIELD
8. PRESSURE TRANSDUCER
9. SCHRADER VALVE
10. BENDIX CONNECTOR
11. END CAP
12. PRINTED CIRCUIT BOARD PC 100
13. IMMERSION LENS
14. BOLOMETER MOUNT
15. PRINTED CIRCUIT BOARD PC 200
16. MAGNETIC VANE
17. BEARINGS
18. OBJECTIVE LENS
19. SCANNING MIRROR
20. WINDOW
21. DUST COVER
22. THERMISTOR FLAKE

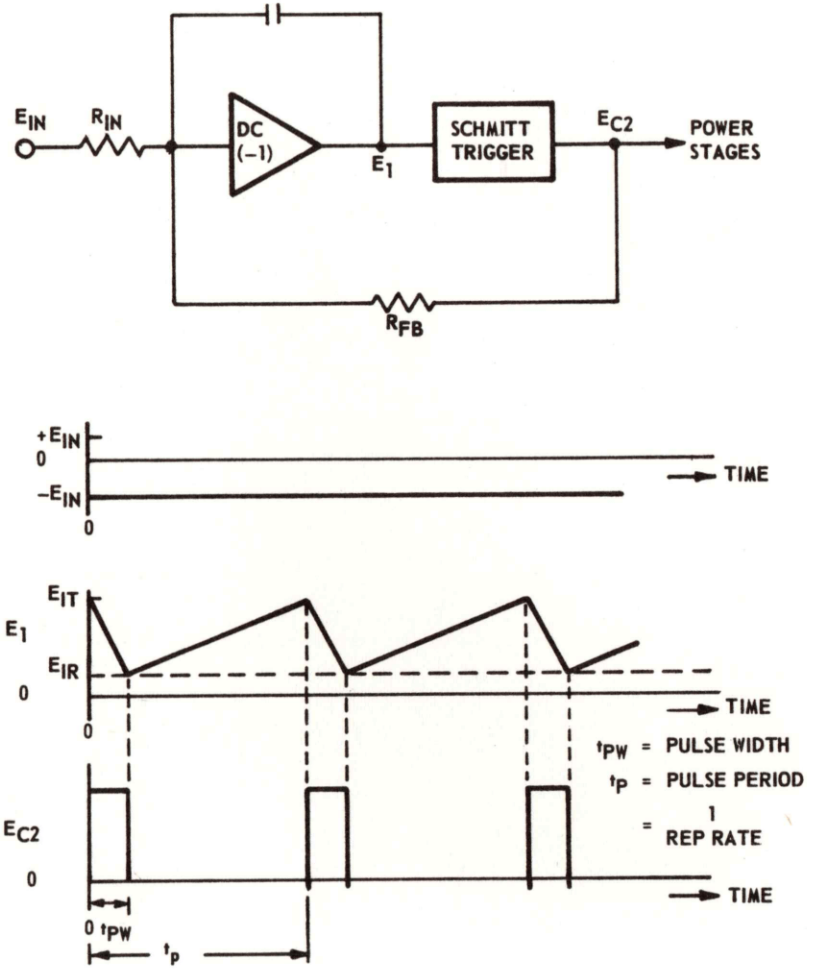
SENSOR HEAD SCANNING PATHS



FLIGHT CONTROL PACKAGE

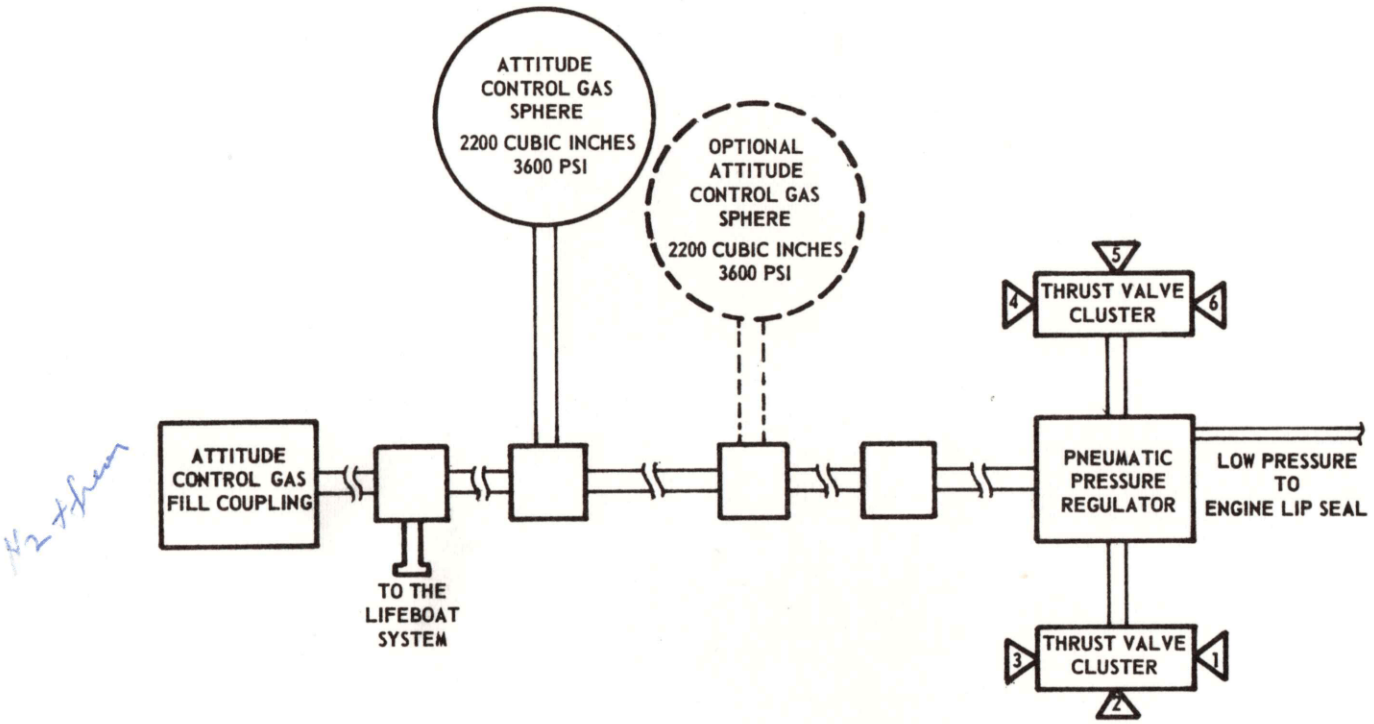


PULSE CIRCUITRY AND WAVEFORMS

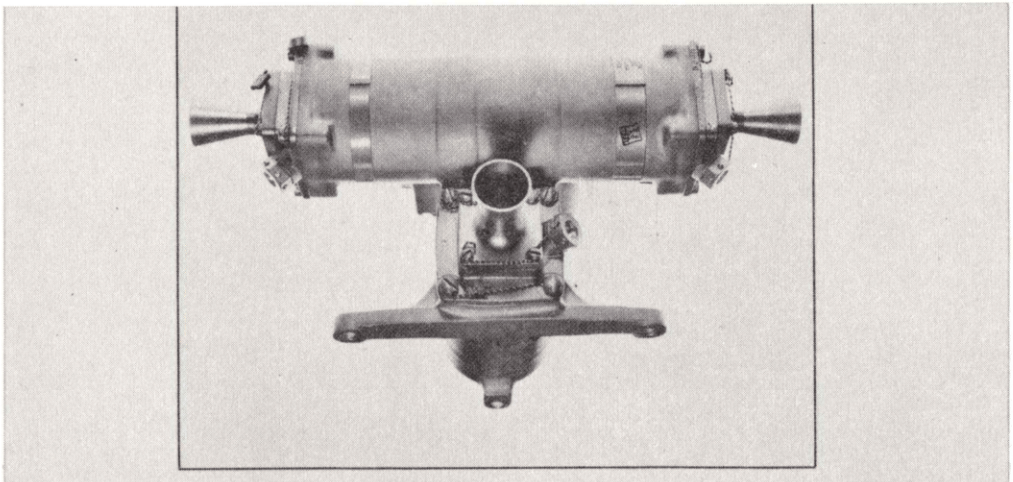


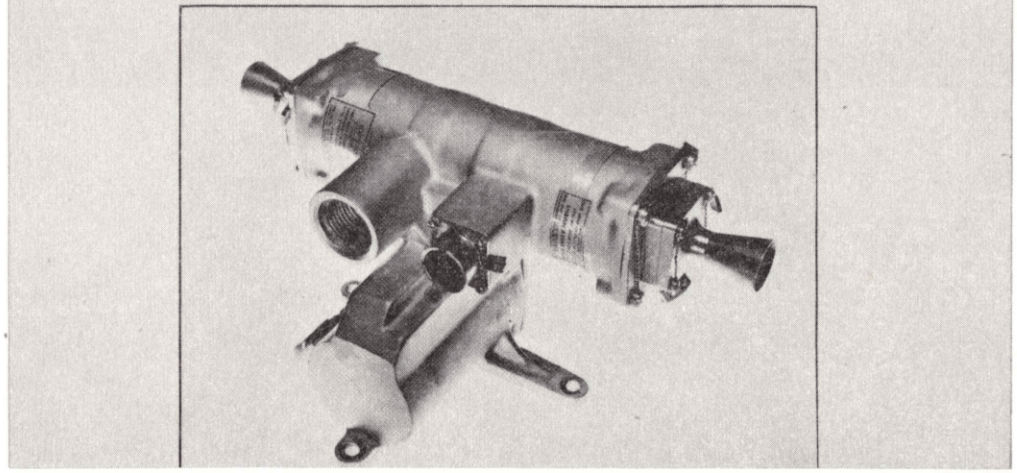
PNEUMATIC ATTITUDE CONTROL SYSTEM

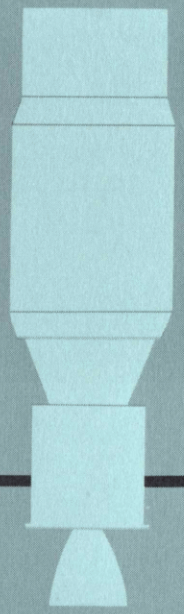
BLOCK DIAGRAM



THRUST VALVE CLUSTER



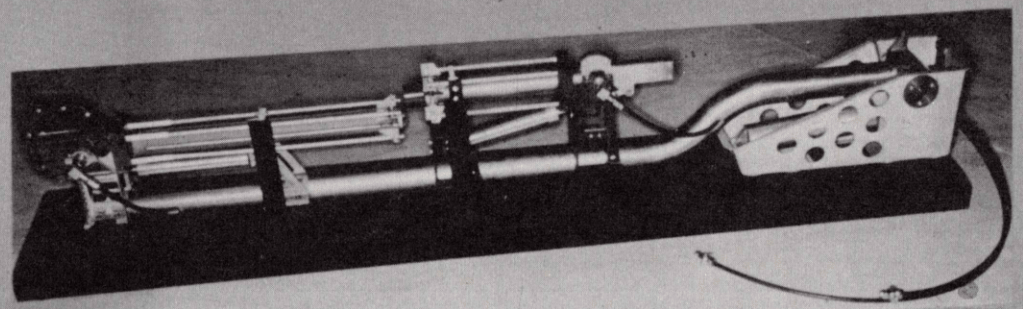




SPACEBORNE ANTENNAS

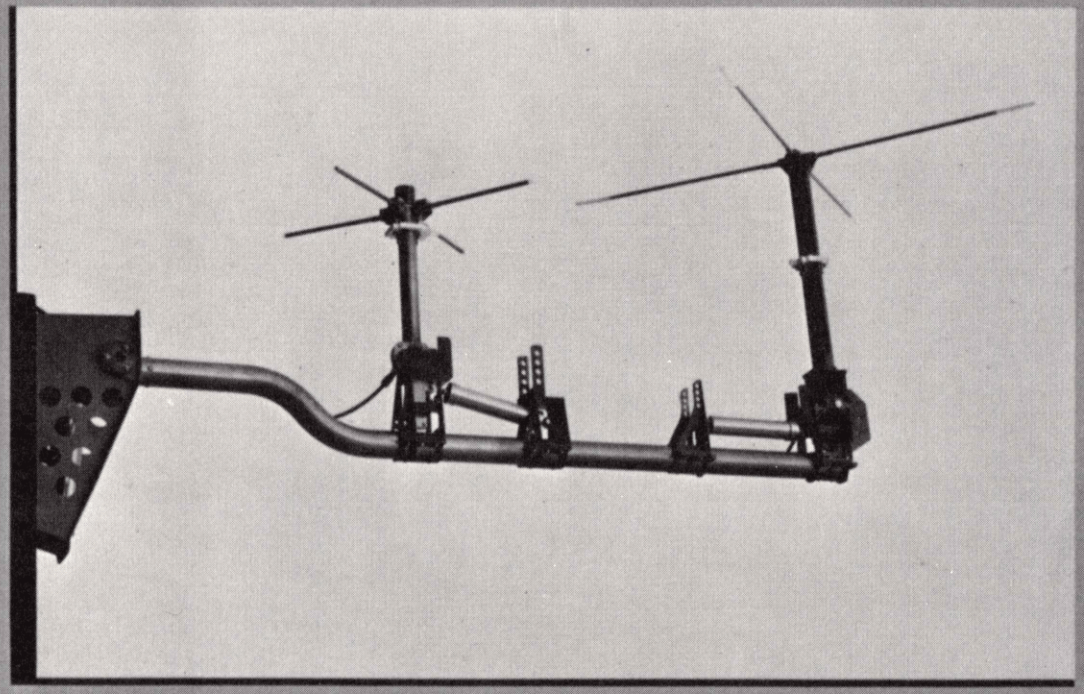
Large Antennas

MECHANICALLY ERECTED ANTENNA SYSTEM (PACKAGED)

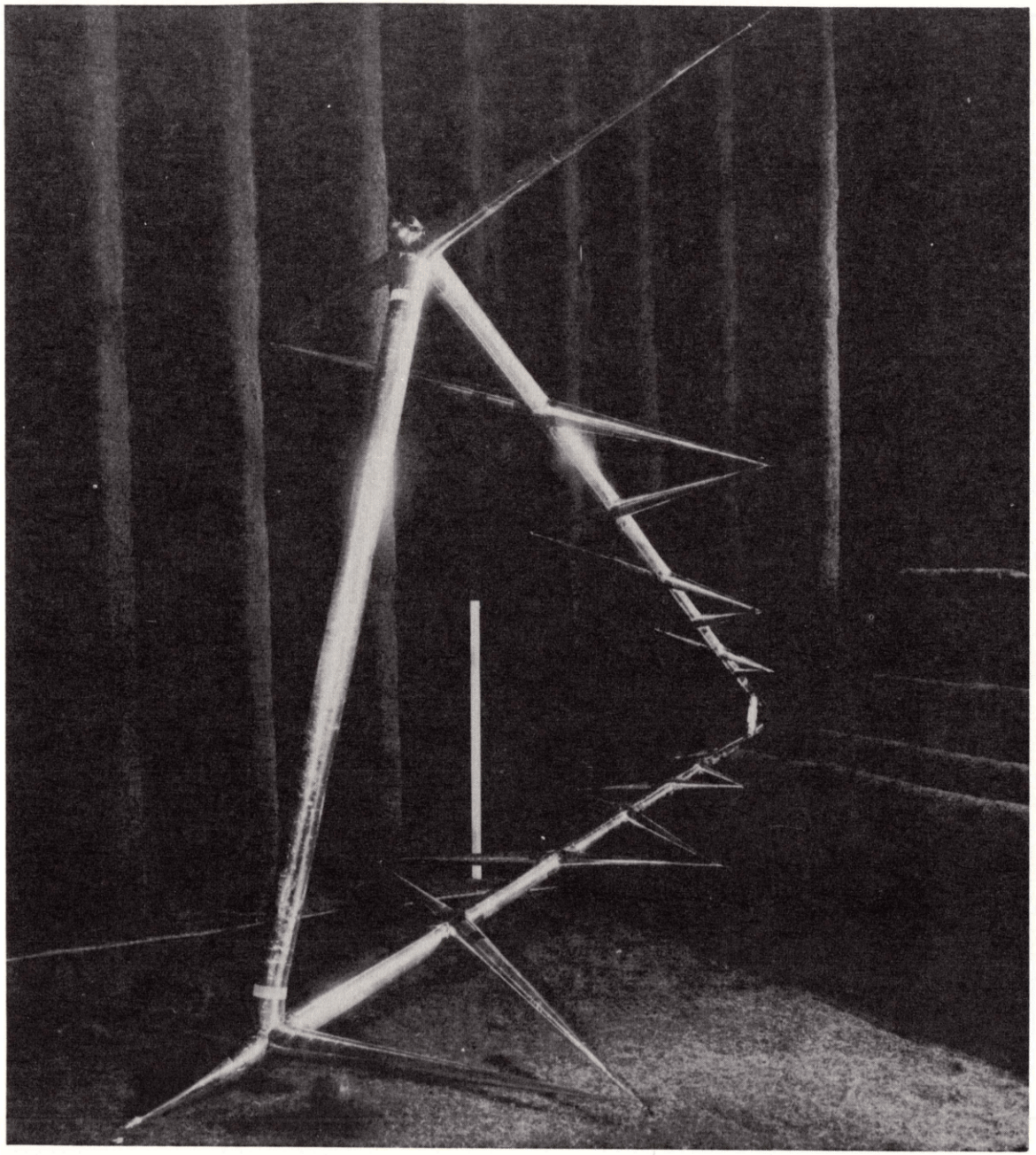


Large Antennas

MECHANICALLY ERECTED ANTENNA SYSTEM (ERECTED)

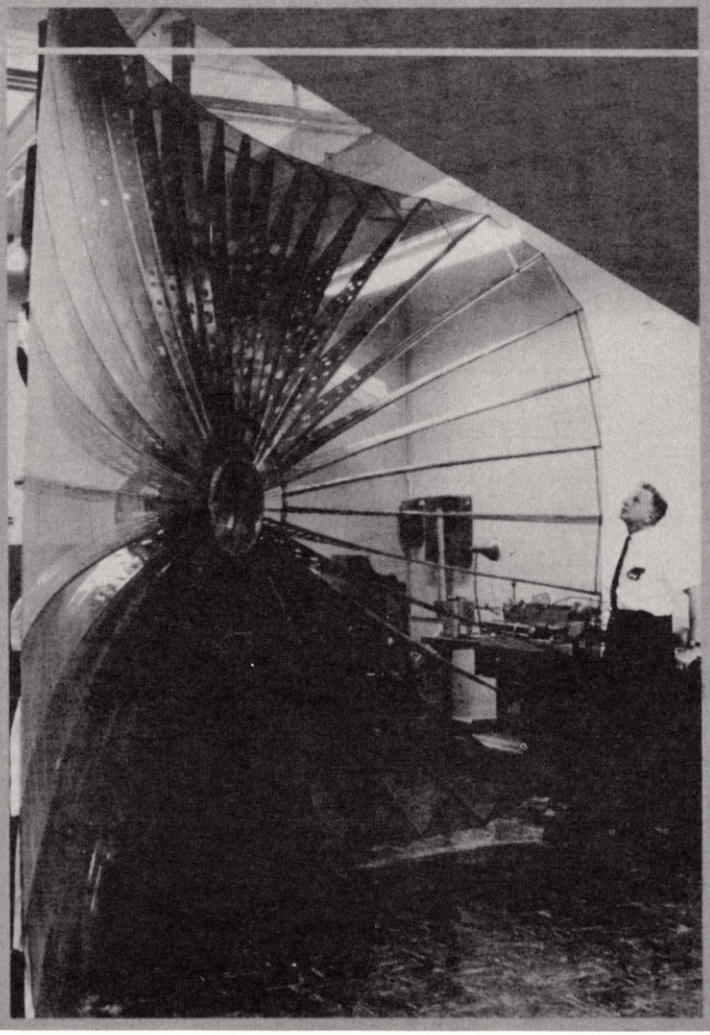


INFLATABLE ANTENNA

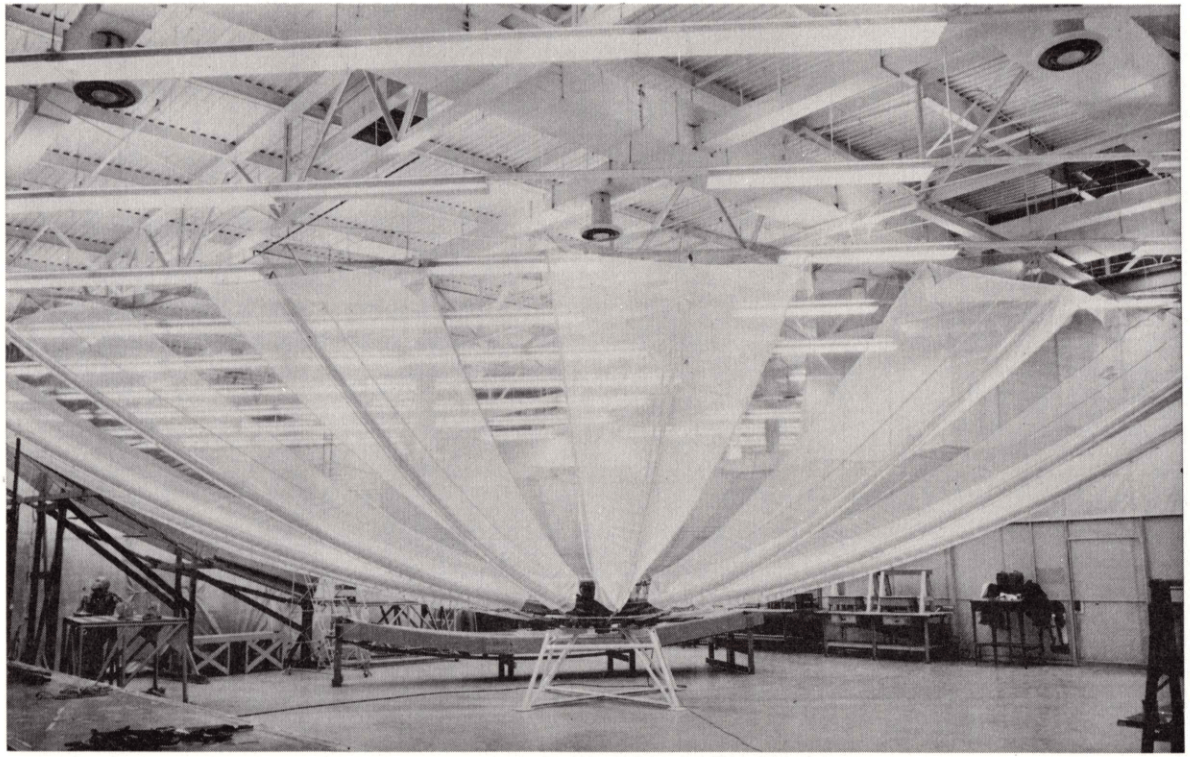


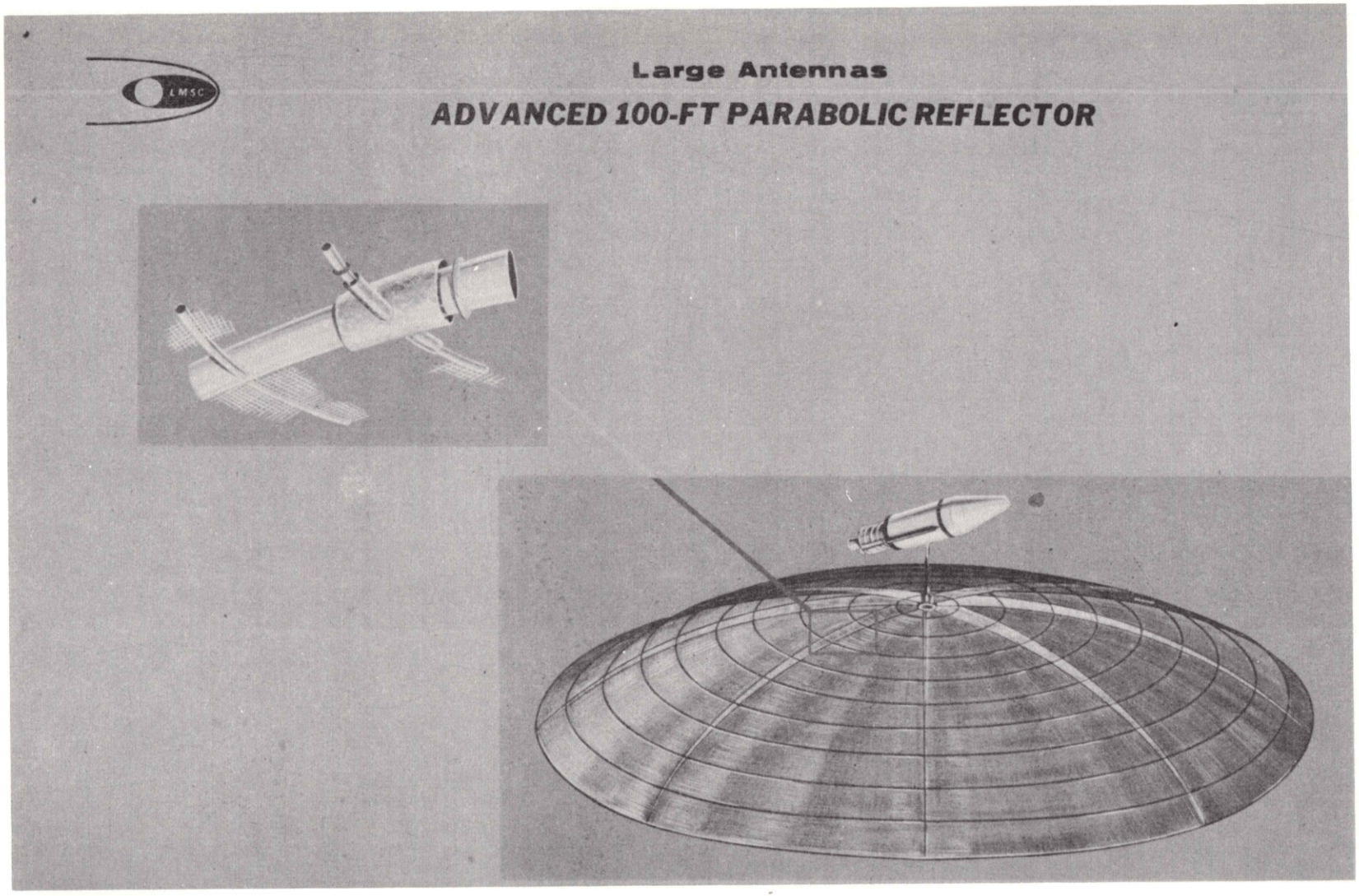
Large Antennas

10 x 15-FT FLEX-RIB PARABOLIC CYLINDER

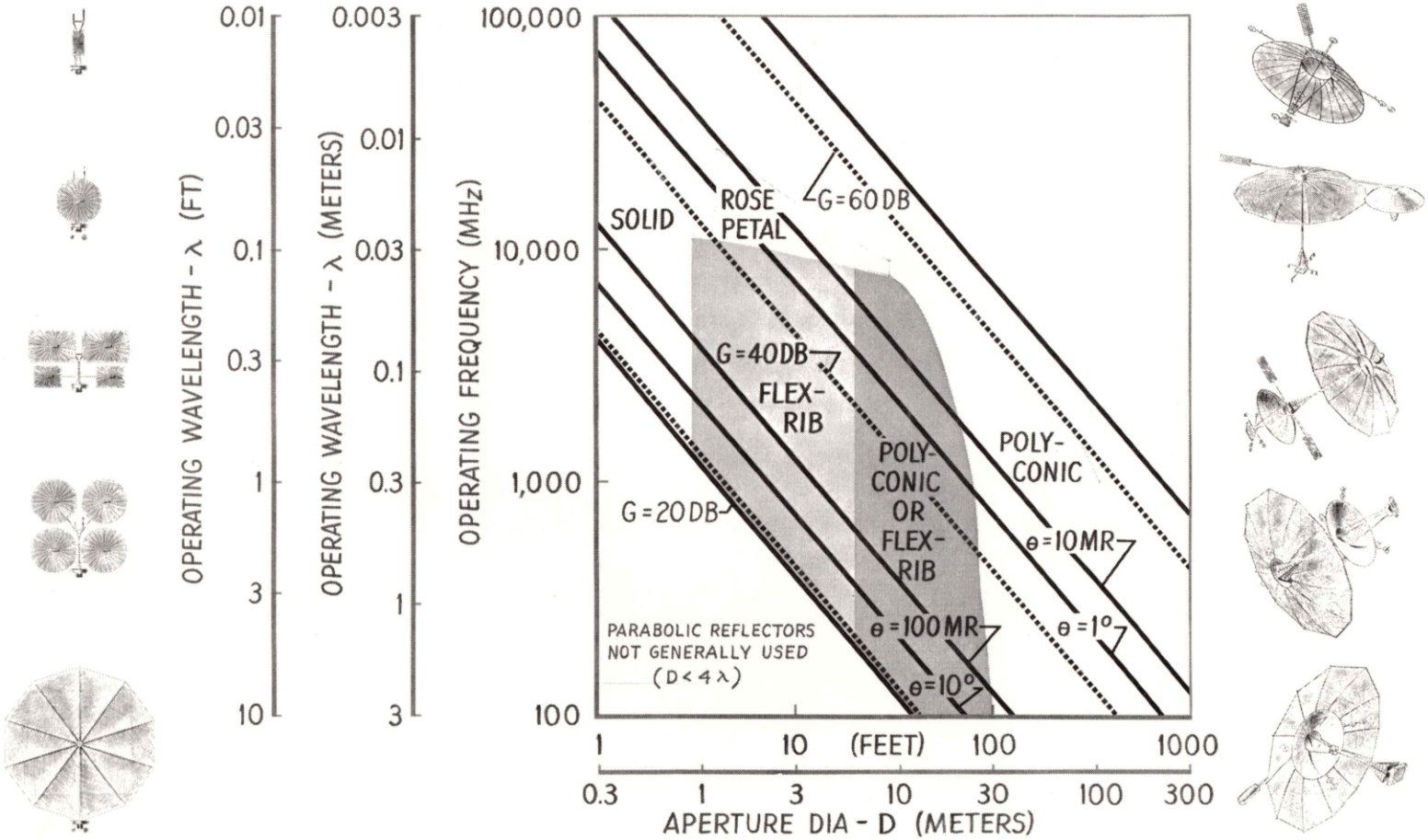


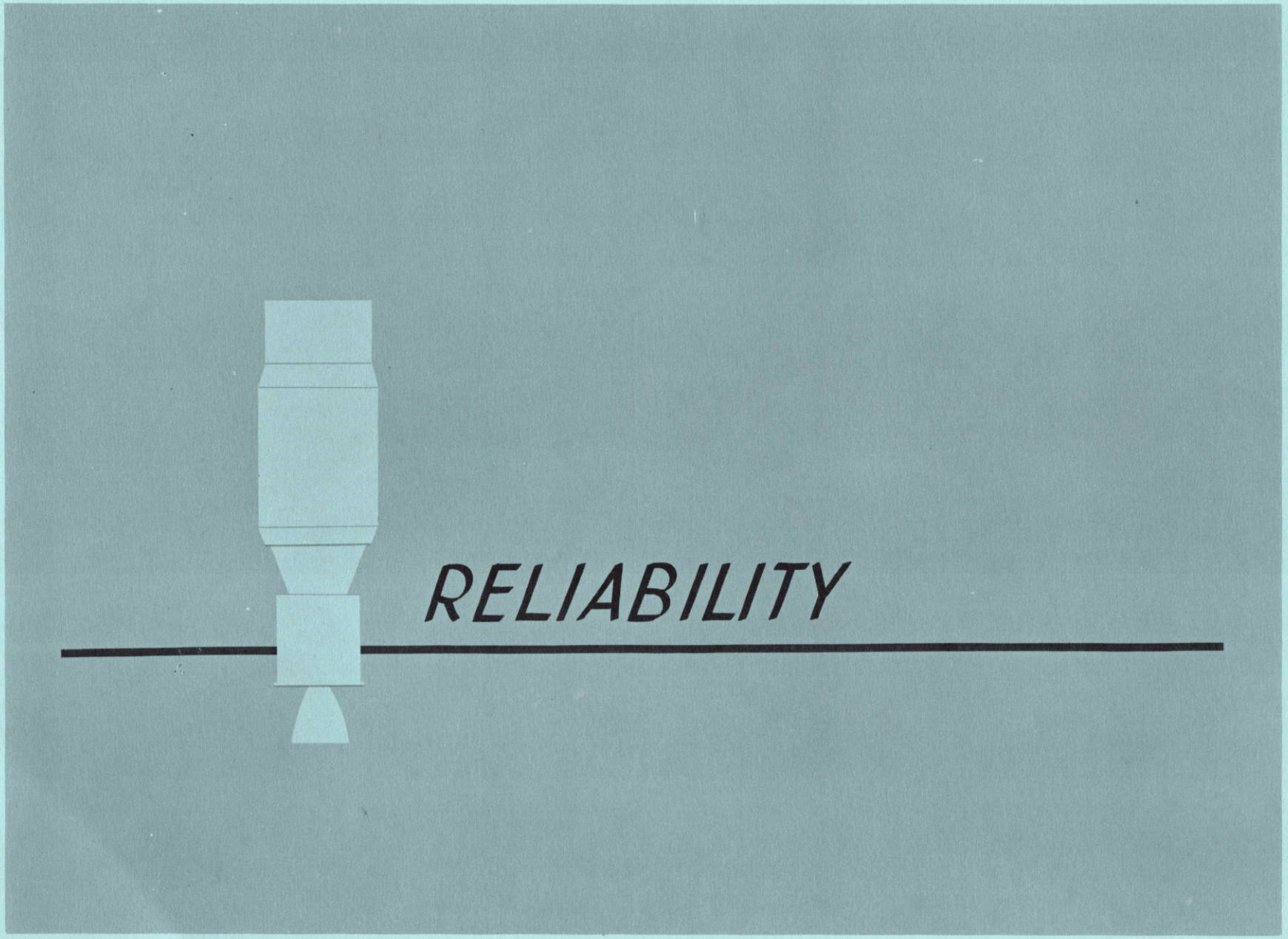
50-Ft. PARABOLIC ANTENNA



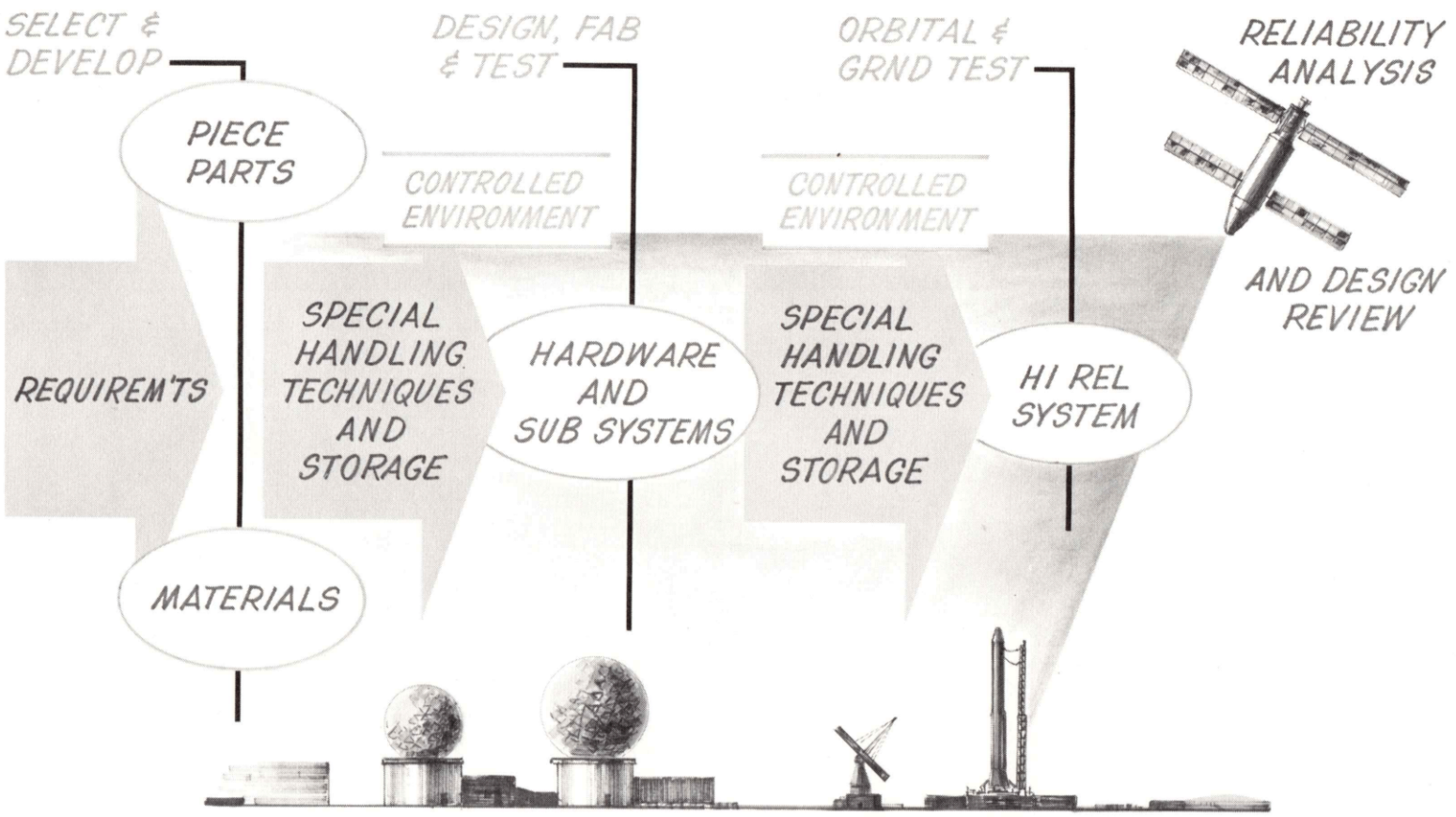

LMSC
Large Antennas
ADVANCED 100-FT PARABOLIC REFLECTOR

SPACEBORNE PARABOLIC ANTENNAS

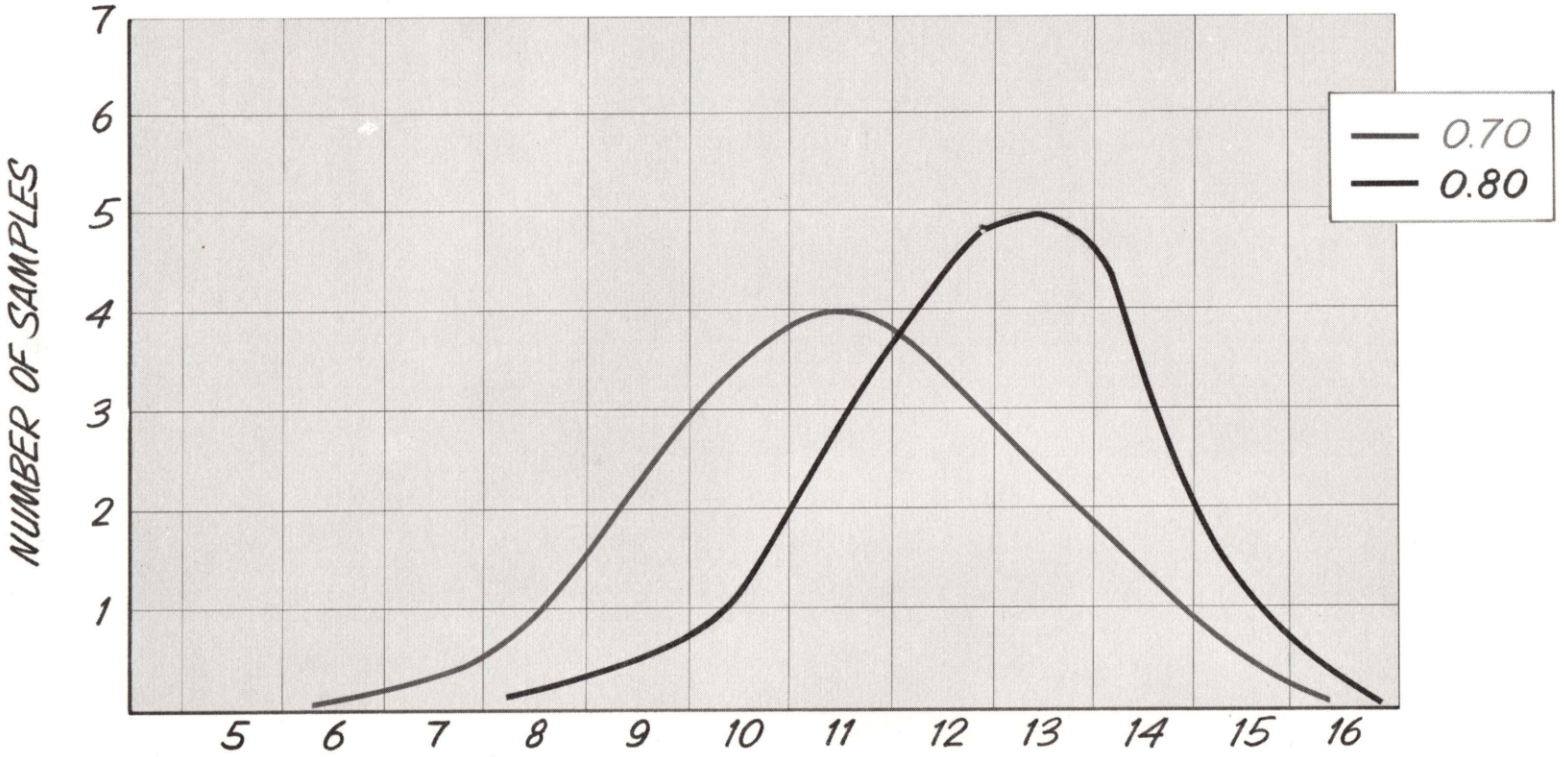



RELIABILITY

ELEMENTS OF RELIABILITY PROGRAM

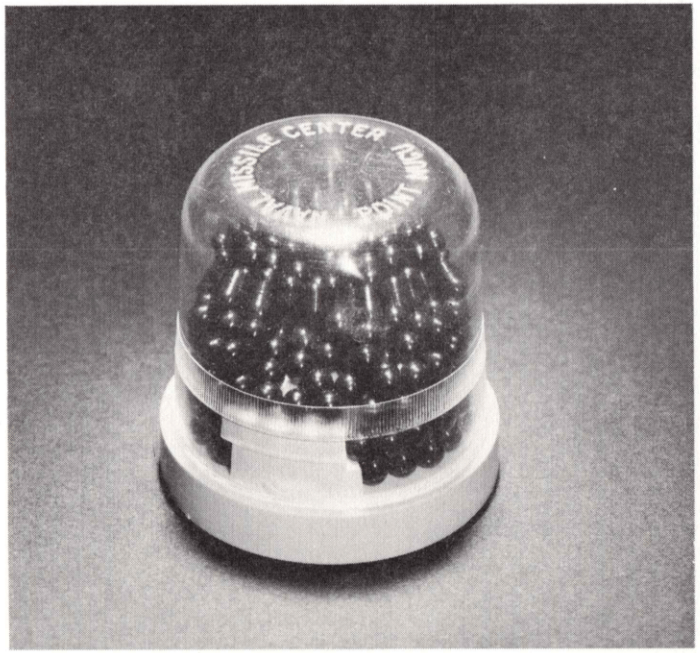


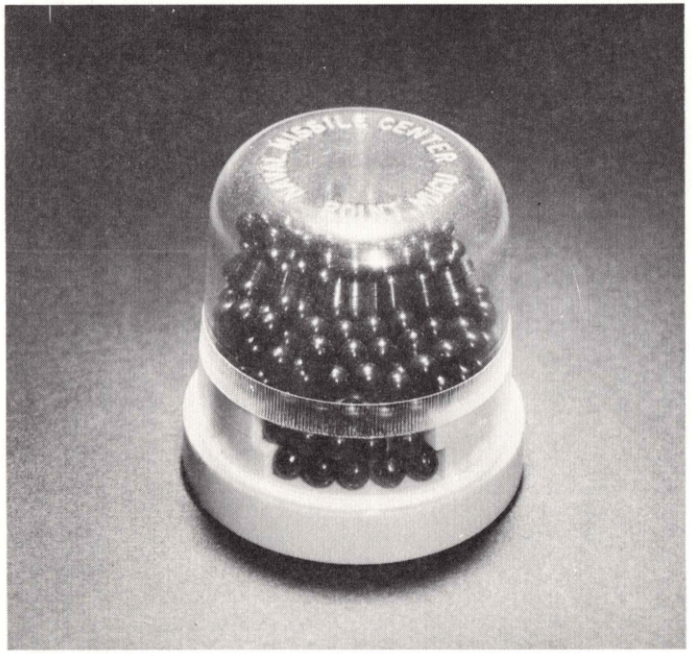
MEASUREMENT OF RELIABILITY



● RED BALLS IN SAMPLE							
● FRACTION OF RED BALLS LEFT IN 0.70 POPULATION	.7 1 2	.7 0 6	.7 0 1	.6 9 6	.6 9 0	6 8 4	.6 7 9

EXPERIMENT IN RELIABILITY





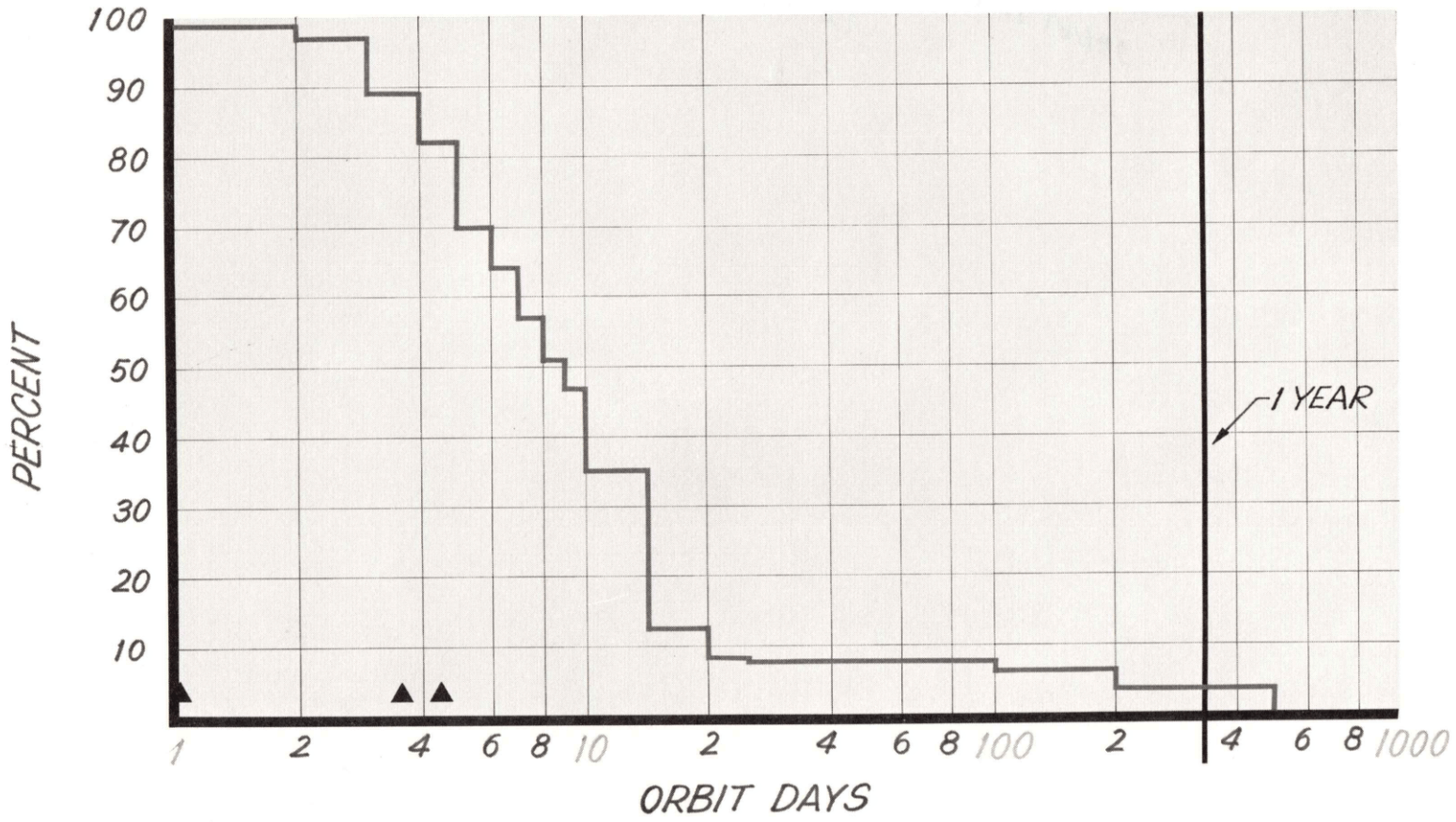
RELIABILITY EXPERIENCE

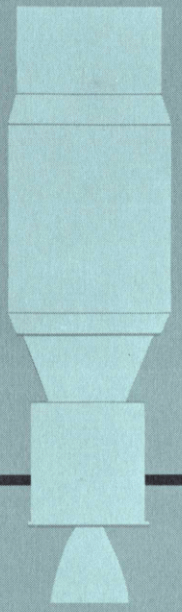
KEY EQUIPMENT AT 50% CONFIDENCE

8096 ENGINE	ASCENT	0.984 *
VELOCITY METER	ASCENT	0.985
INERTIAL REFERENCE PACKAGE	14-DAY ORBIT	0.987
HORIZON SENSOR	14-DAY ORBIT	0.950
POWER SUBSYSTEM	14-DAY ORBIT	0.957

* AT 90% CONFIDENCE

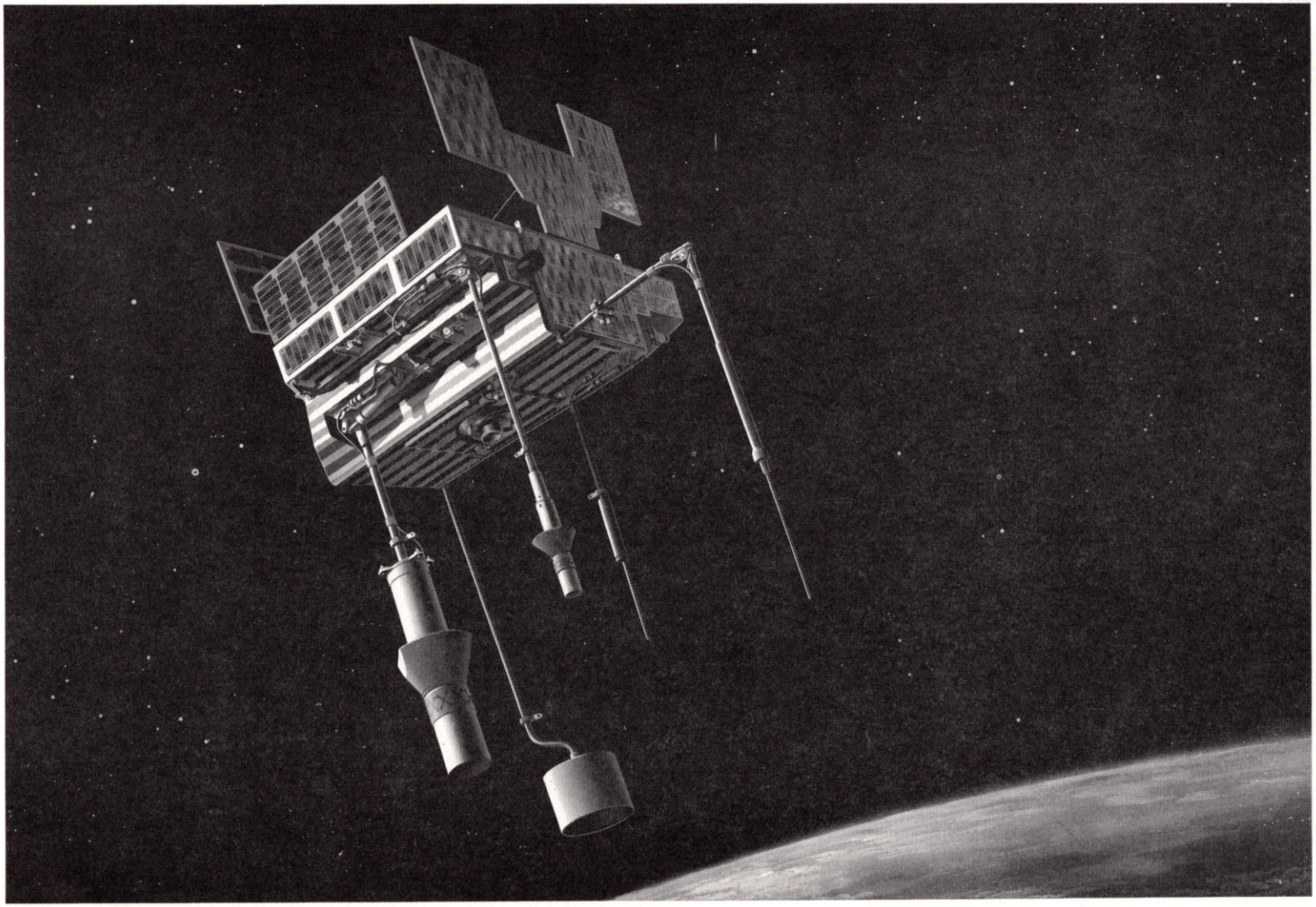
ORBIT EXPERIENCE





SPACE EXPERIMENTS CAPABILITY

CALIBRATION SATELLITE



P-11/RESEARCH PAYLOADS

P-11

- 100 LBS OF PAYLOAD
- ORBIT 250 CIRCULAR TO 250 X 1600 NM
- 6 MONTHS LIFE
- SUBSYSTEMS AVAILABLE
  - COMMAND
  - POWER
  - DATA
    - VHF
    - S-BAND

5000 watt hr/day

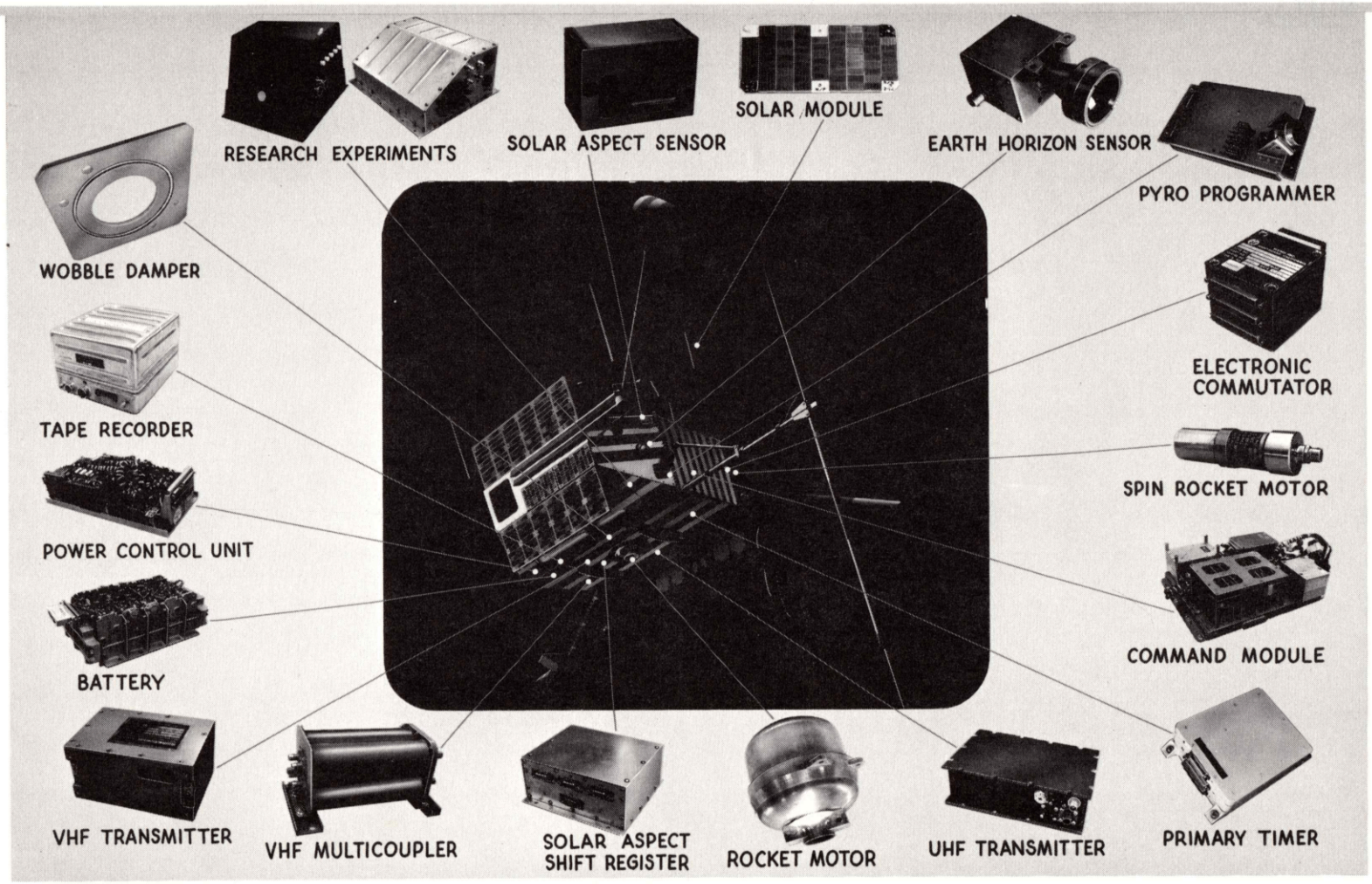
RESEARCH PAYLOADS

- > 400 EXPERIMENTS FLOWN
- > 60 EXPERIMENTERS
- > 115 PAYLOAD MODULES FLOWN

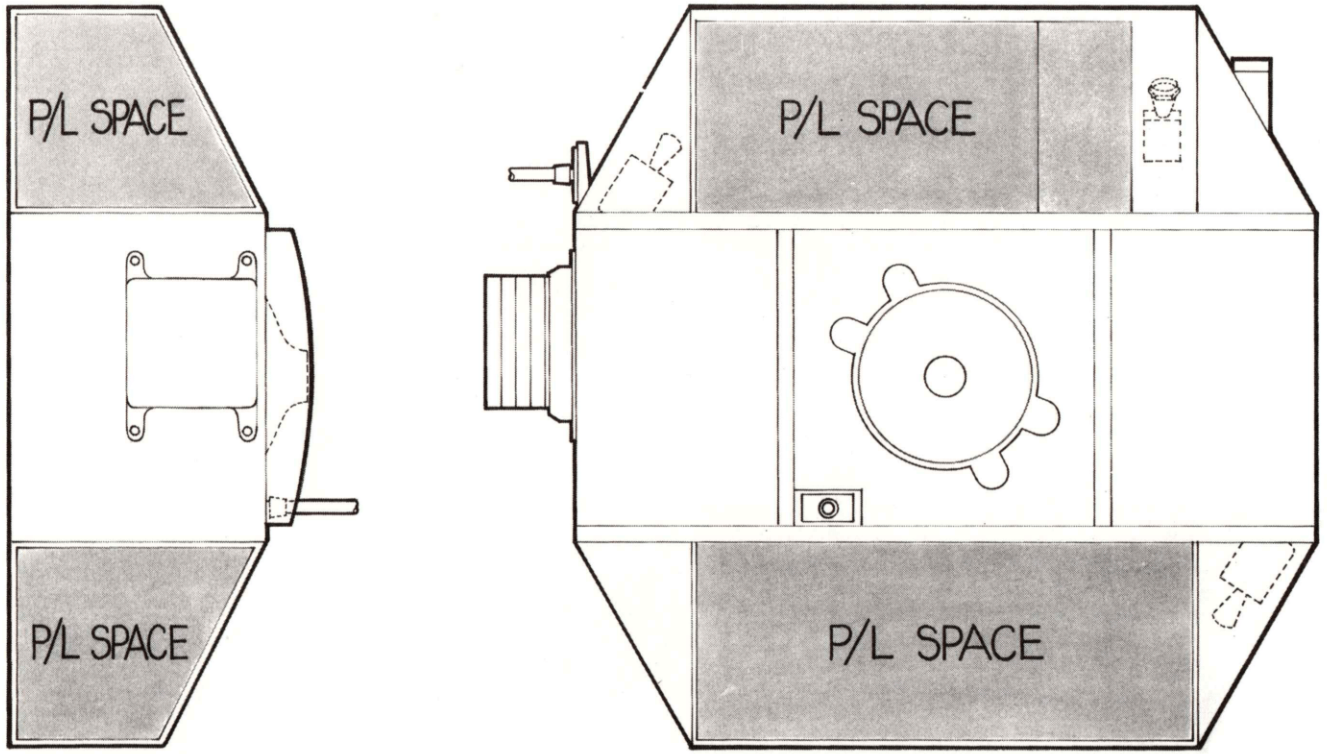
P-11 PROGRAM FEATURES

- FAST SCHEDULE — 30 WEEKS CONFIGURATION DEFINITION TO LAUNCH
- LOW COST — 475K PLUS PECULIARIZATION AND PAYLOAD
- LONG LIFE — 9 MONTHS AVERAGE
  50 % OPERATED > 1 YEAR
- FREE RIDES — 846, ETC.

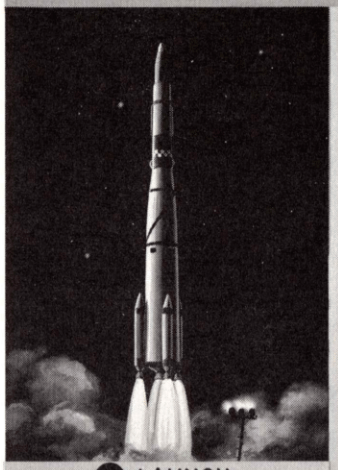
SPACECRAFT CONFIGURATION



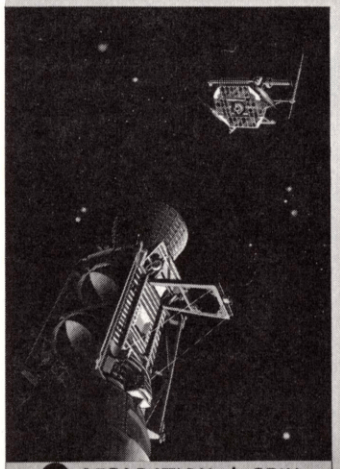
P-11 COMPONENT & PAYLOAD LOCATION



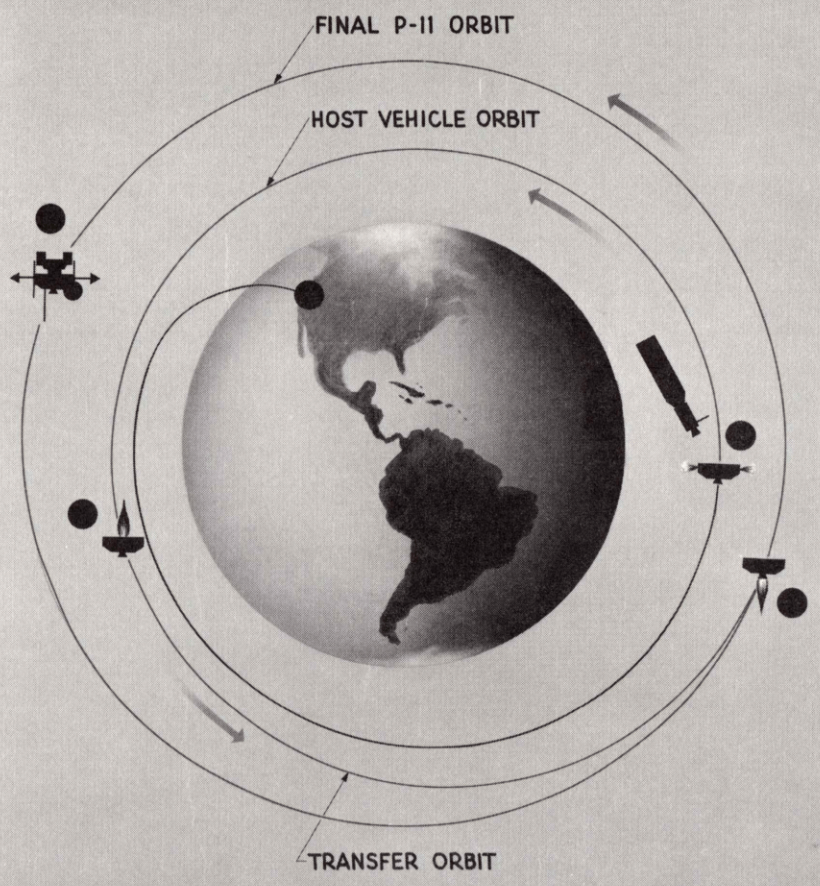
SEQUENCE OF LAUNCH EVENTS

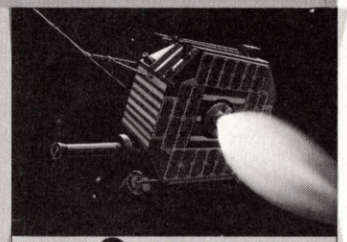


LAUNCH

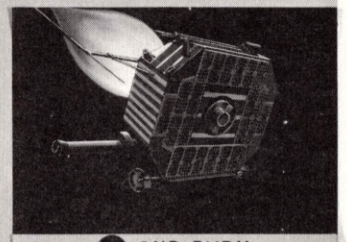


SEPARATION & SPIN

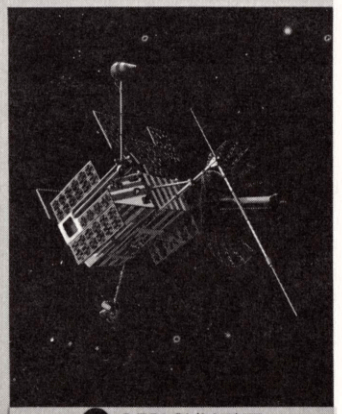




1ST BURN

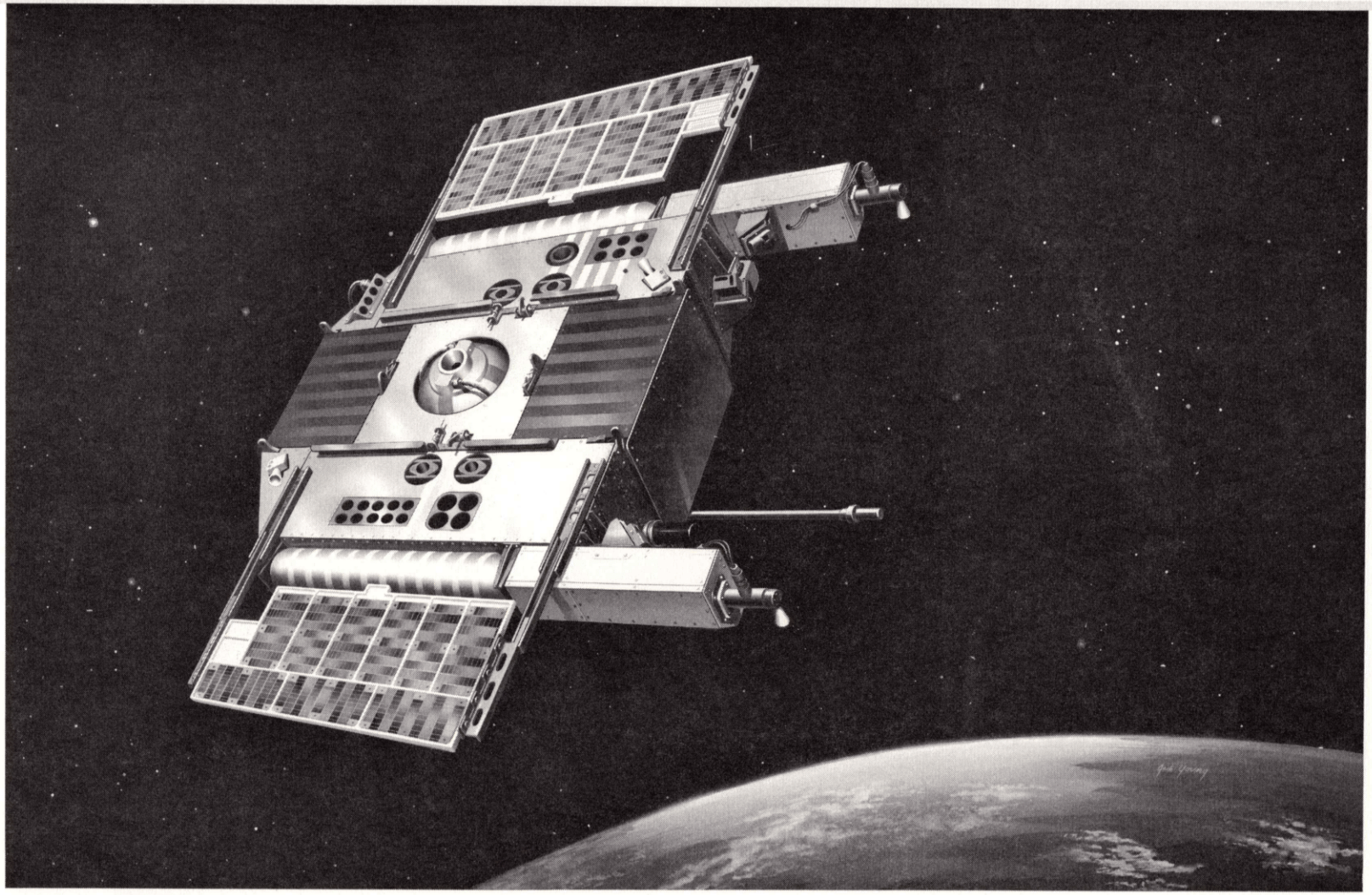


2ND BURN

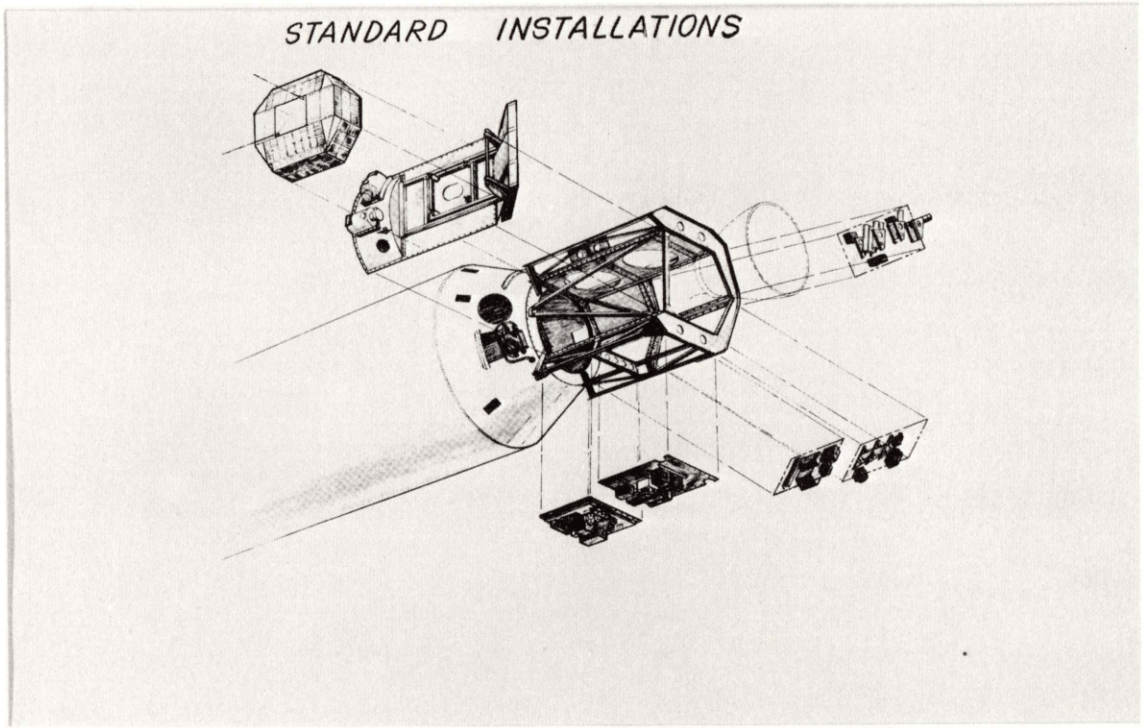


DEPLOYMENT

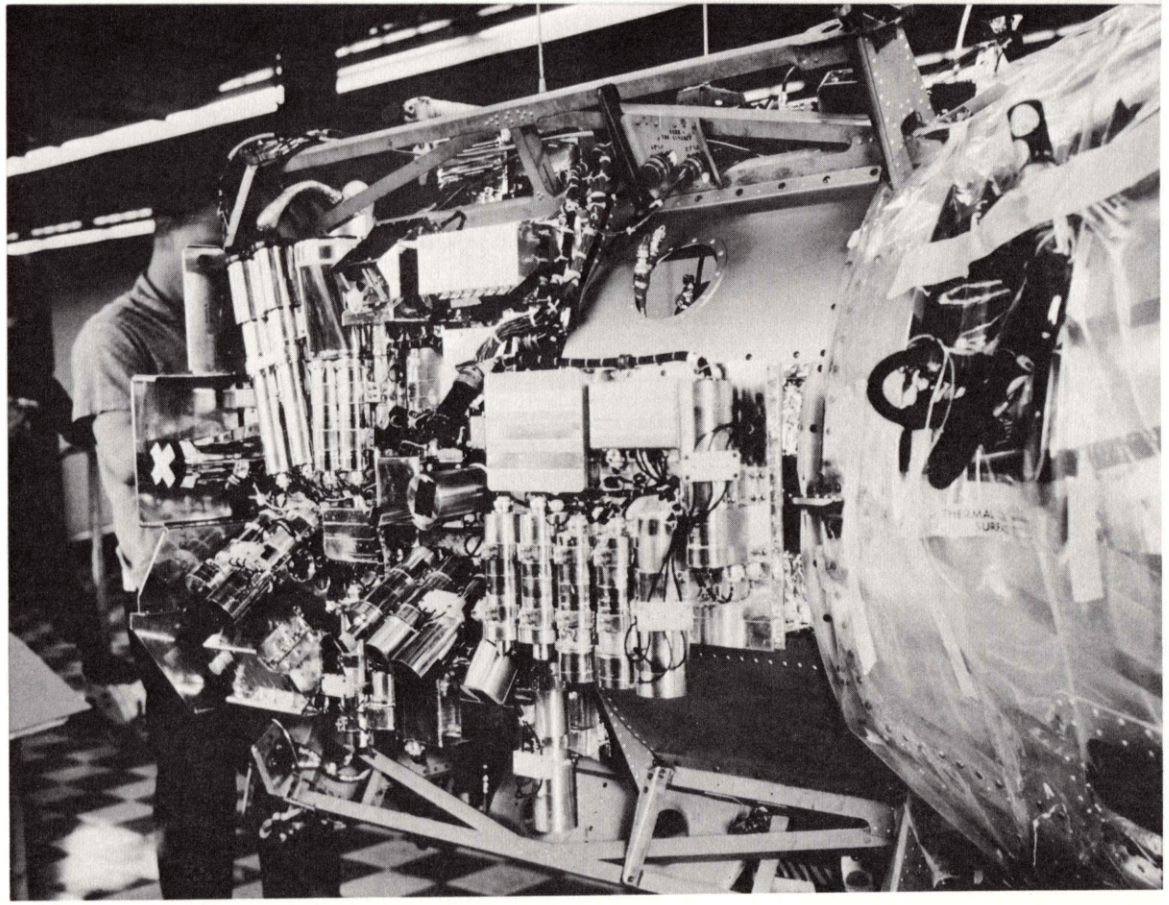
ASTEC / P-11



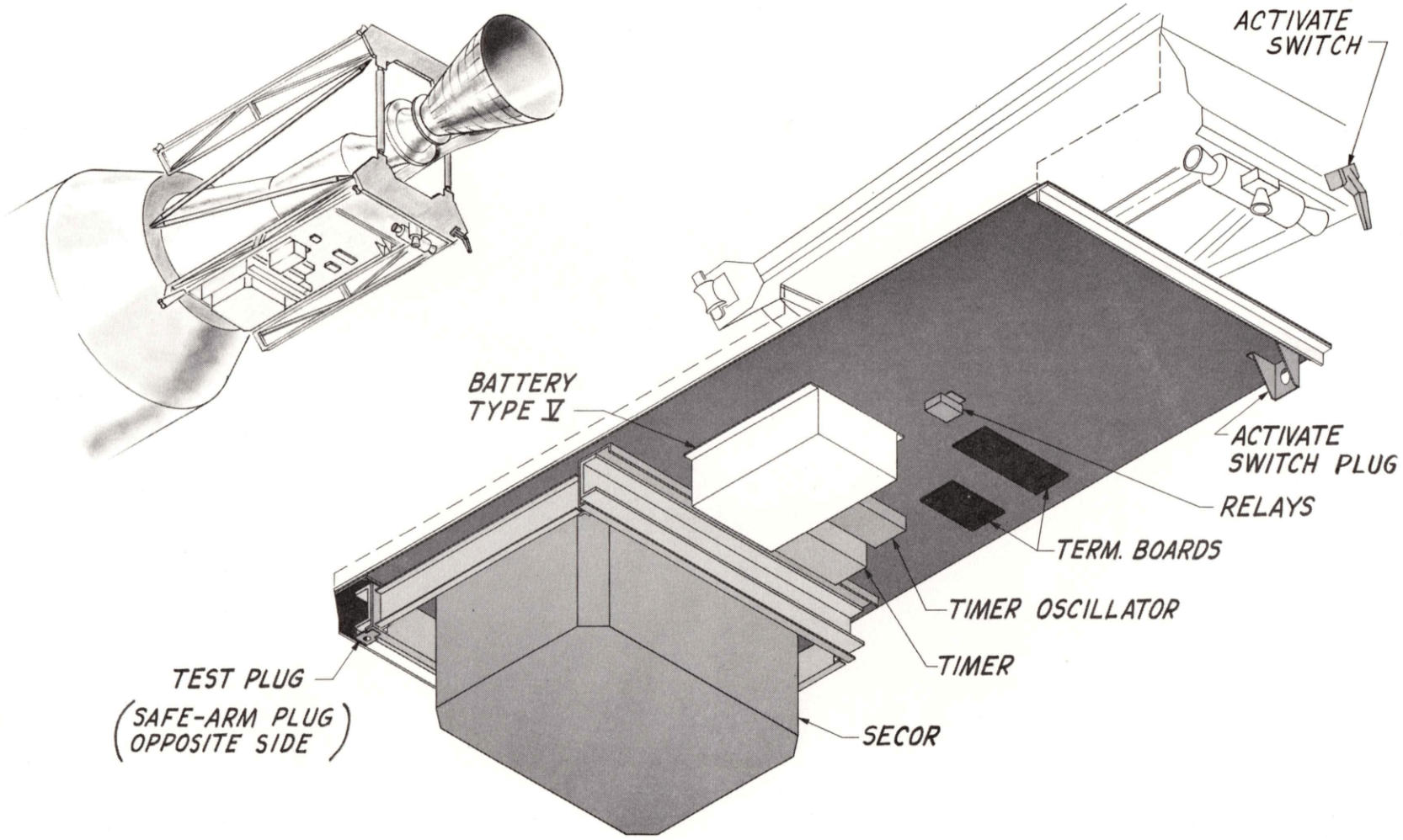
RESEARCH PAYLOADS



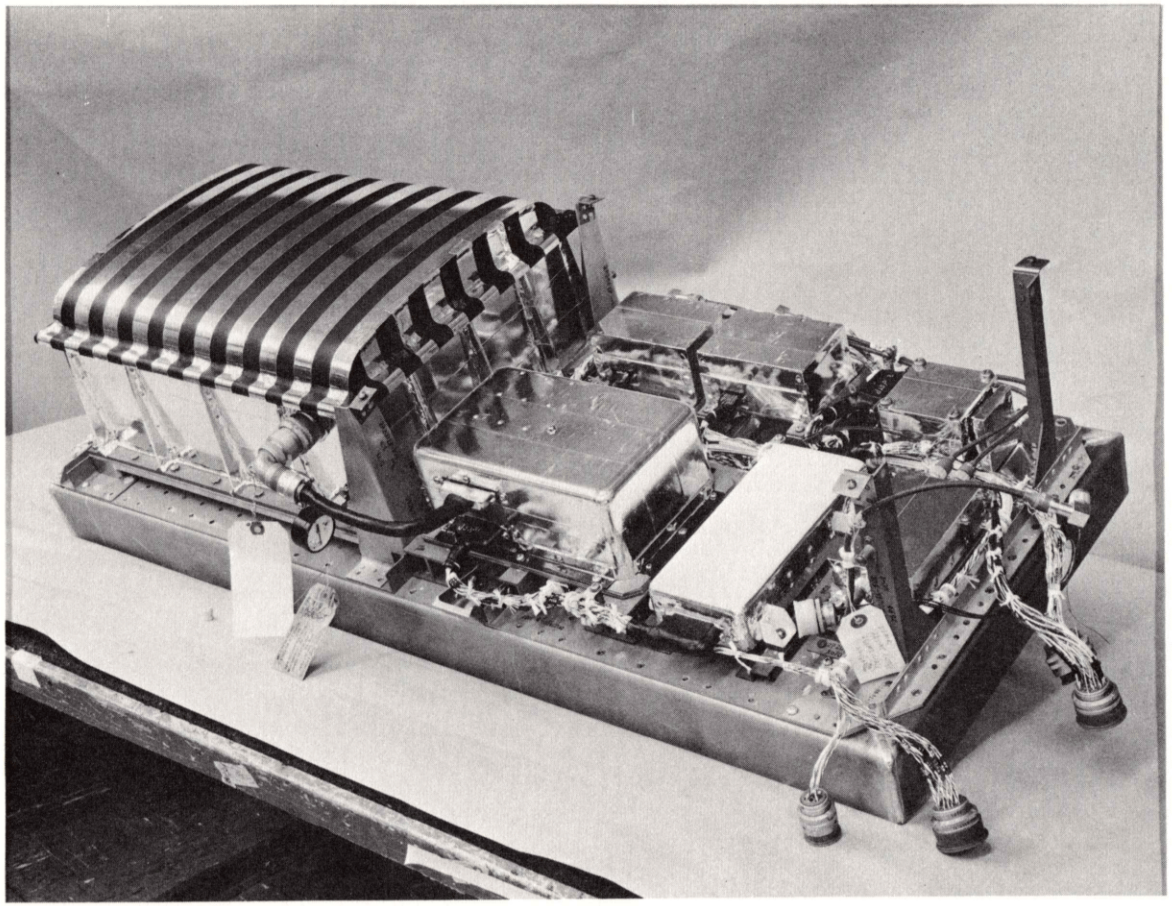
MODULE 454, DASA



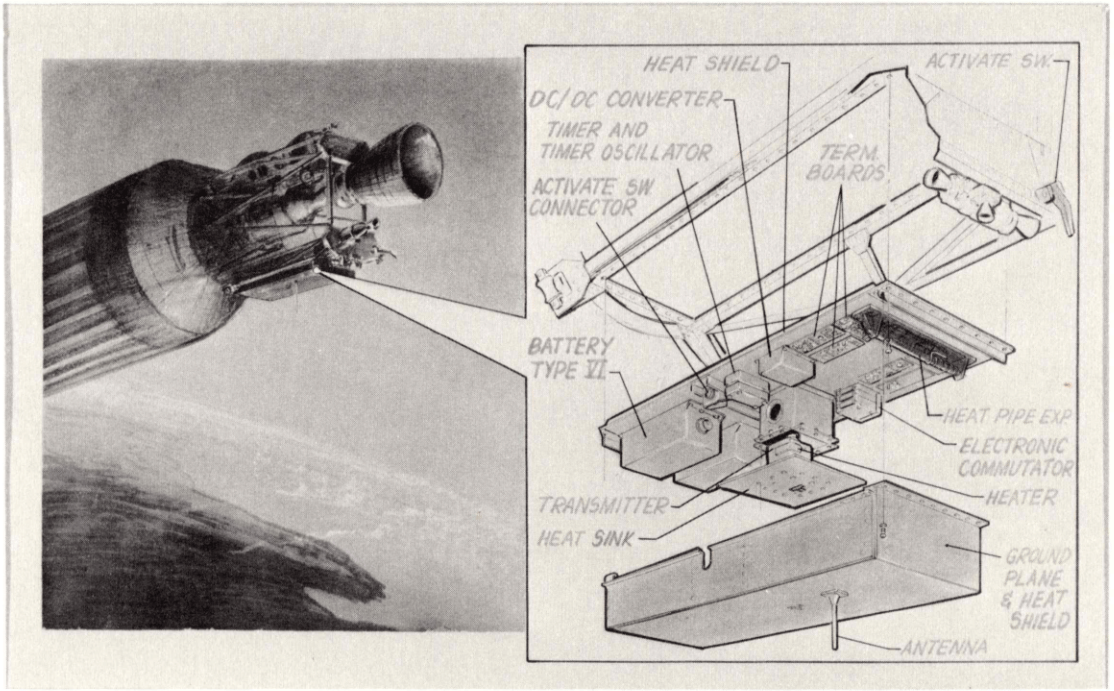
RESEARCH PAYLOAD MOD 482 (SECOR)



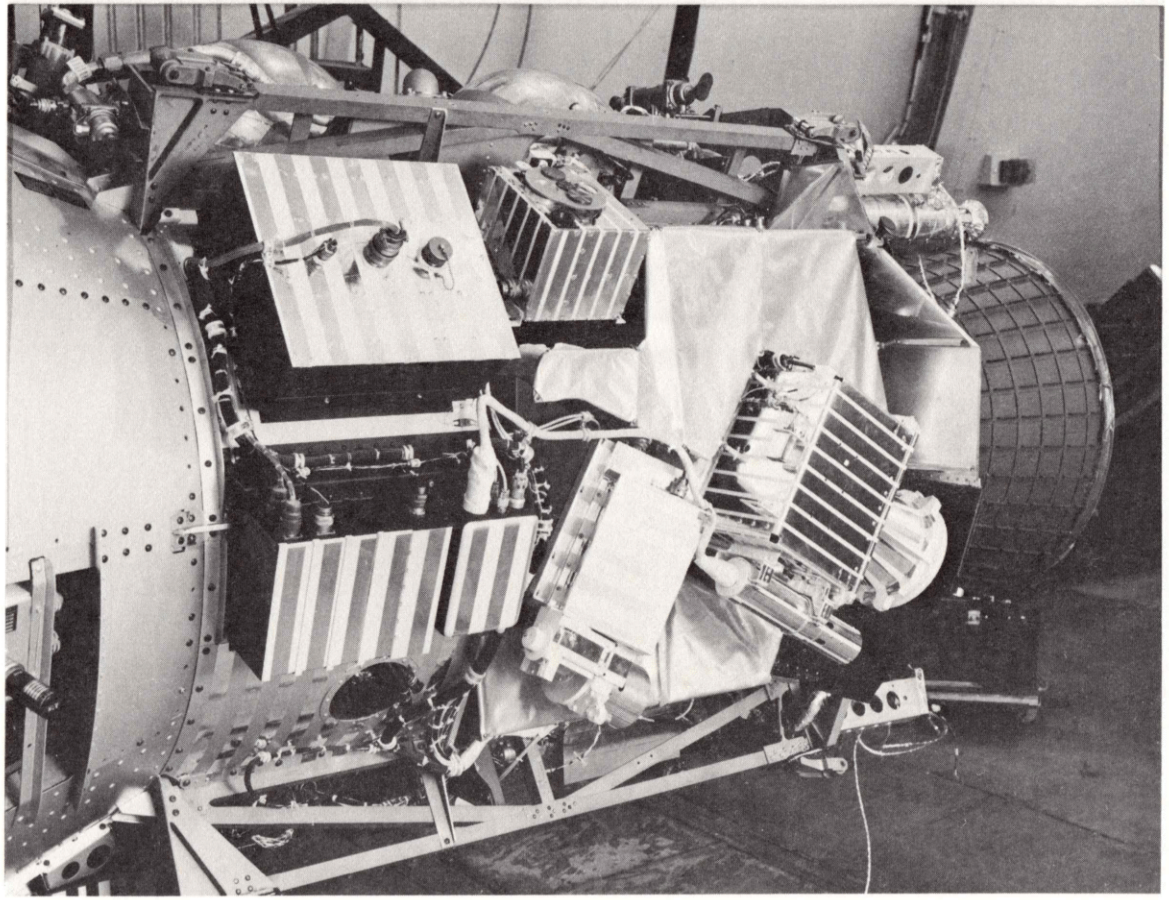
MODULE 464, LOGACS



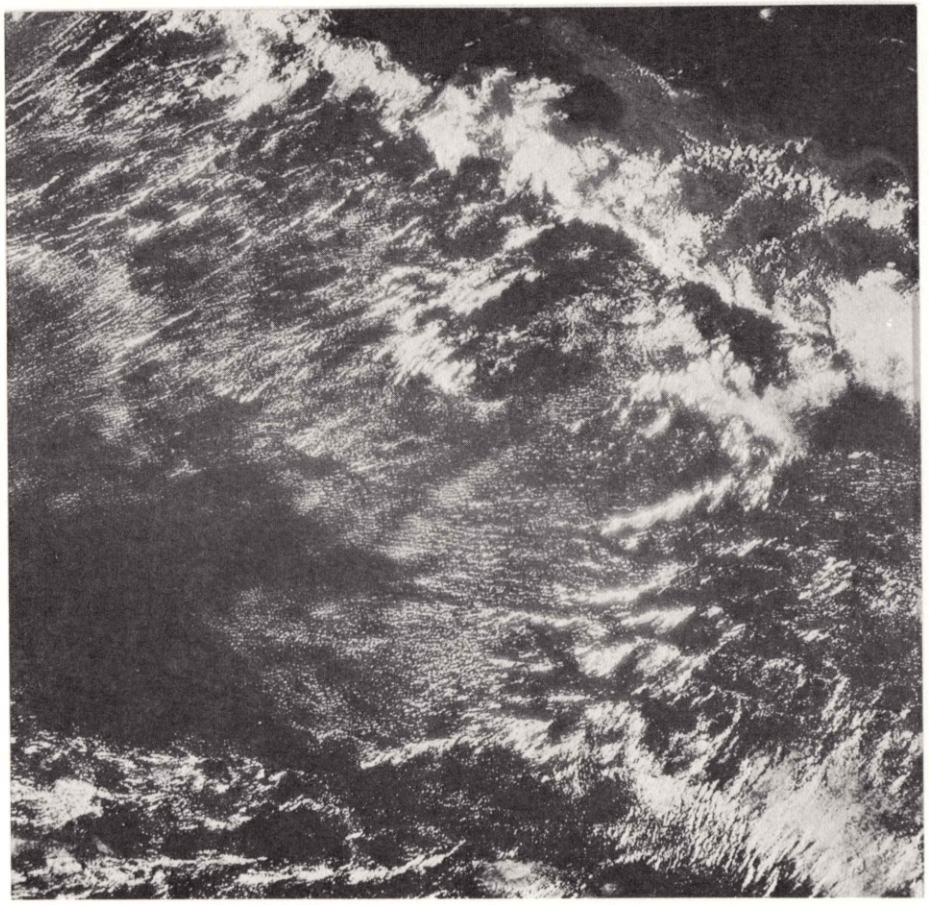
MODULE 481, HEAT PIPE



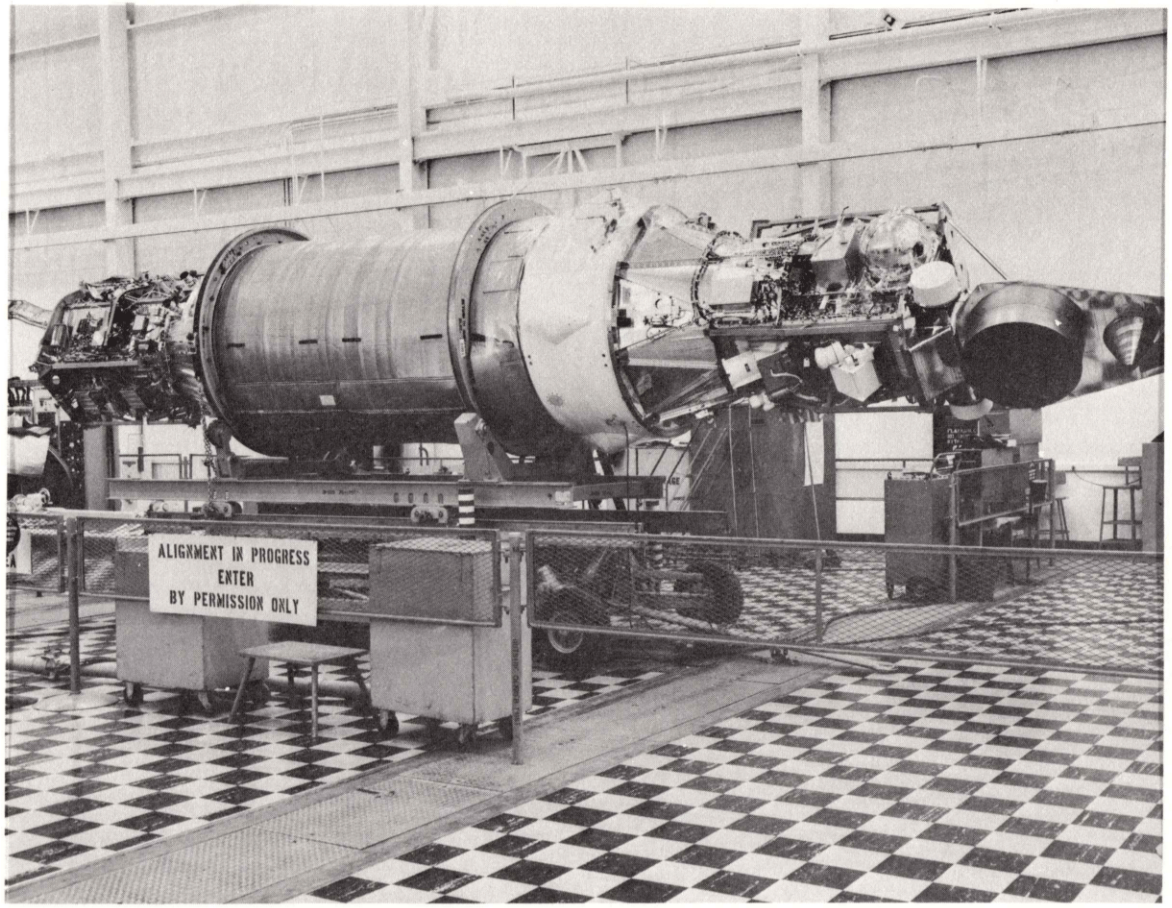
MODULE 283, RADIOMETRIC SOLAR X-RAY EXPERIMENT



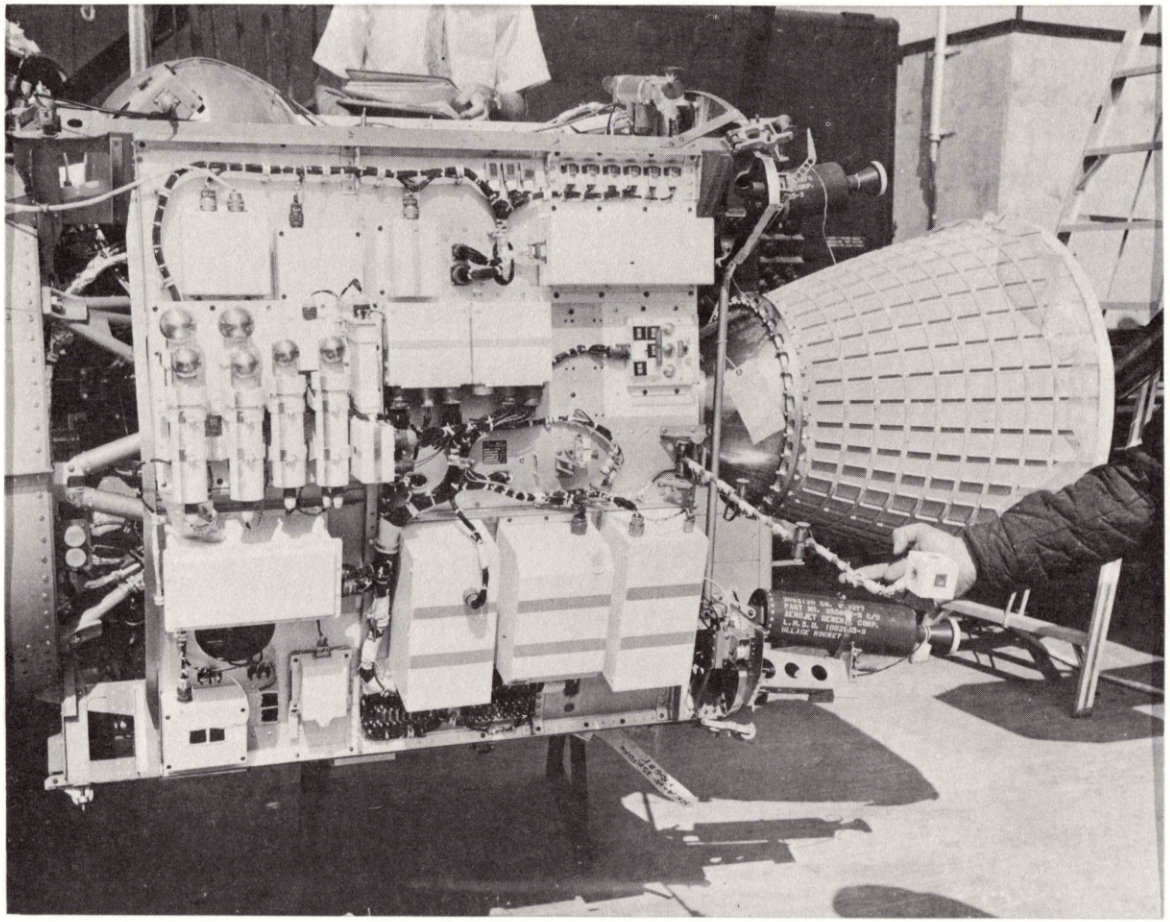
CLOUD COVER

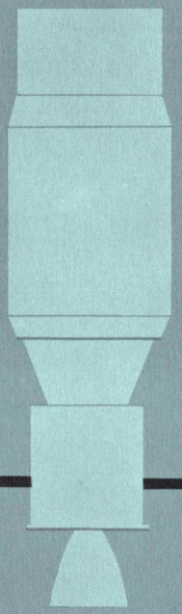


MODULE 602

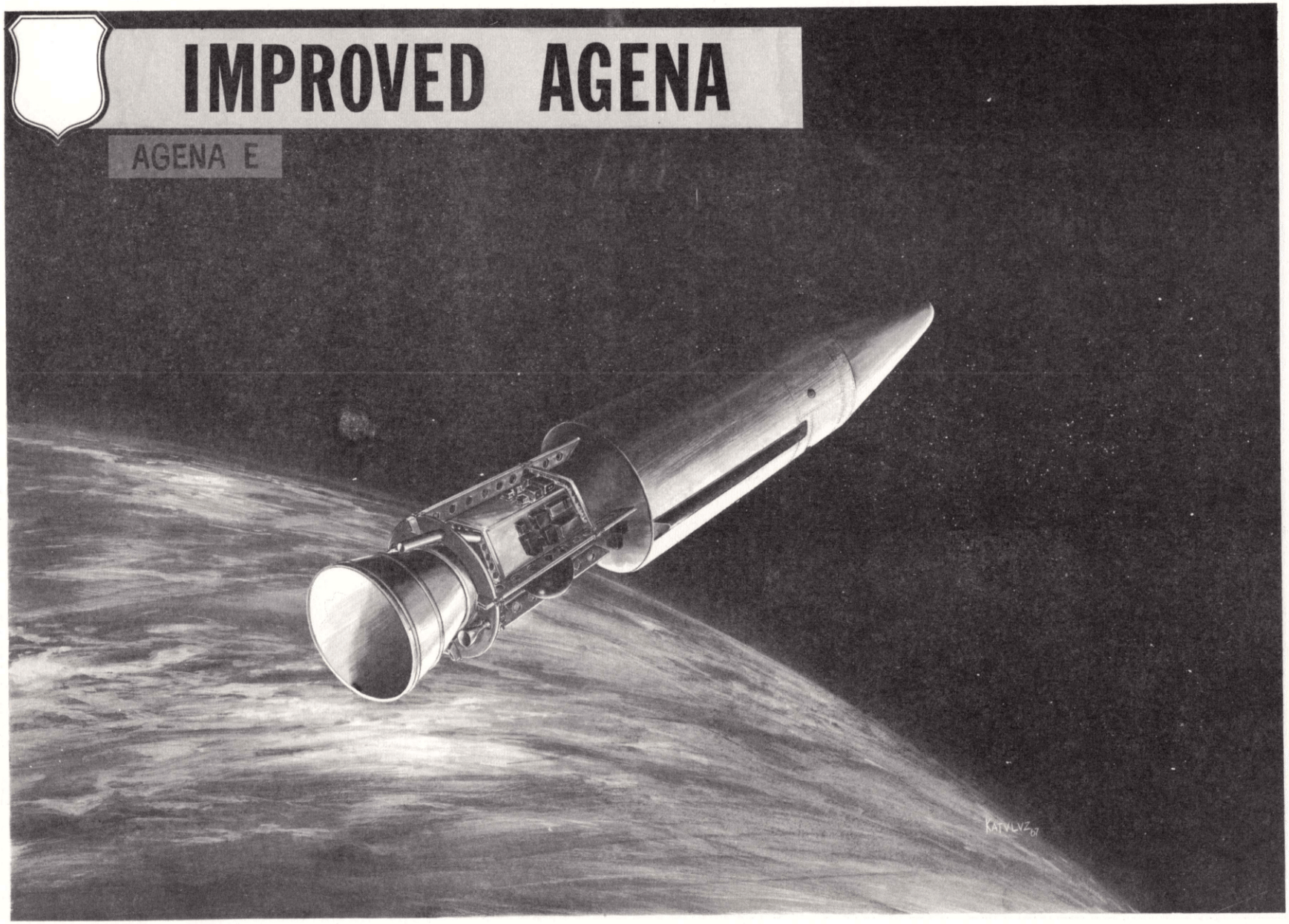


MODULE 1401, STARAD

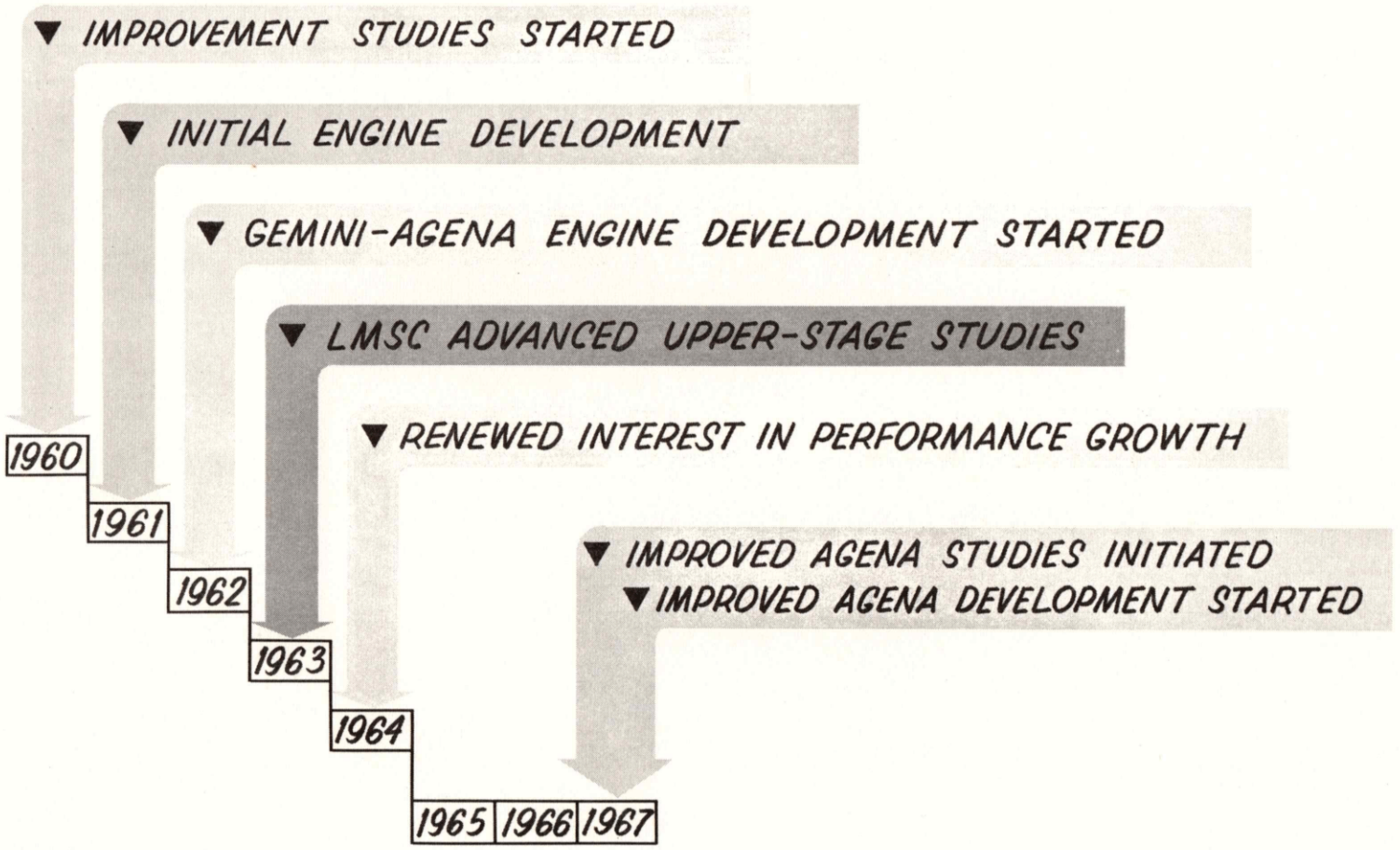




IMPROVED AGENA


IMPROVED AGENA
AGENA E

IMPROVED AGENA HISTORY



IMPROVED AGENA

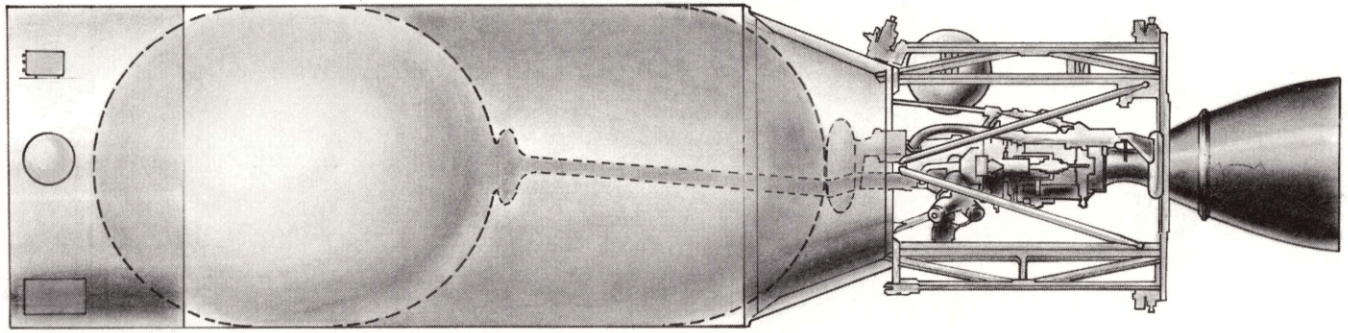
DESIGN REQUIREMENTS BASELINE

MISSION	● 5 SPECIFIED MISSIONS UTILIZING: THORAD SLV-2G ATLAS SLV-3A TITAN IIIB SLV-5 ● ACCOMMODATE P-11 ON AFT RACK
PERFORMANCE	● ADDITIONAL PAYLOAD ON ALL BOOSTERS ● INCREASED MANEUVERING BY MULTI-START PROPULSION: PRIMARY SYSTEM - 5 STARTS SECONDARY SYSTEM - 20 STARTS - 250,000 LB/SEC IMPULSE ● INCREASED STRUCTURAL CAPABILITY
OPERATIONAL CAPABILITY	● ORBIT LIFETIME 21 DAYS (45-DAY GOAL) ● PAD HOLD 15 DAYS - WET (30-DAY GOAL) ● FACTORY TO LAUNCH 180 DAYS
CONSTRAINTS	● MAINTAIN PRESENT ENVELOPE ● MAINTAIN PRESENT RELIABILITY ● MAXIMUM USE OF EXISTING HARDWARE

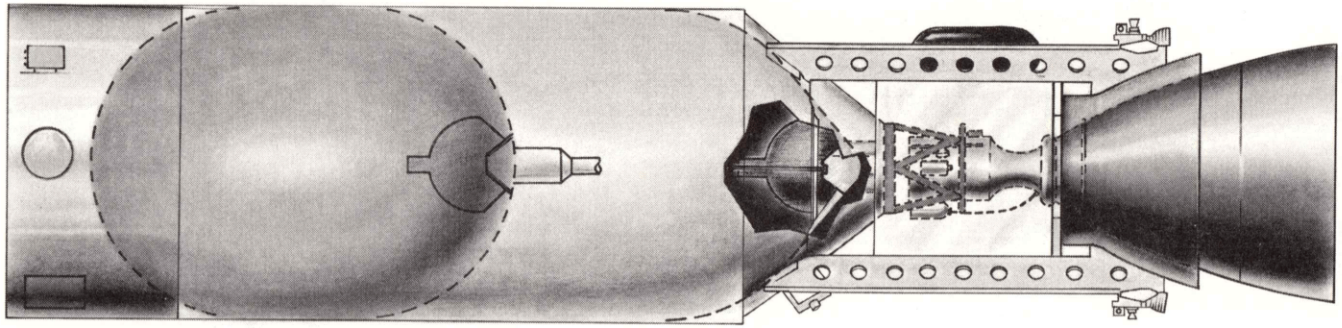
IMPROVED AGENA

CONFIGURATION COMPARISON

SS-01B



IMPROVED AGENA

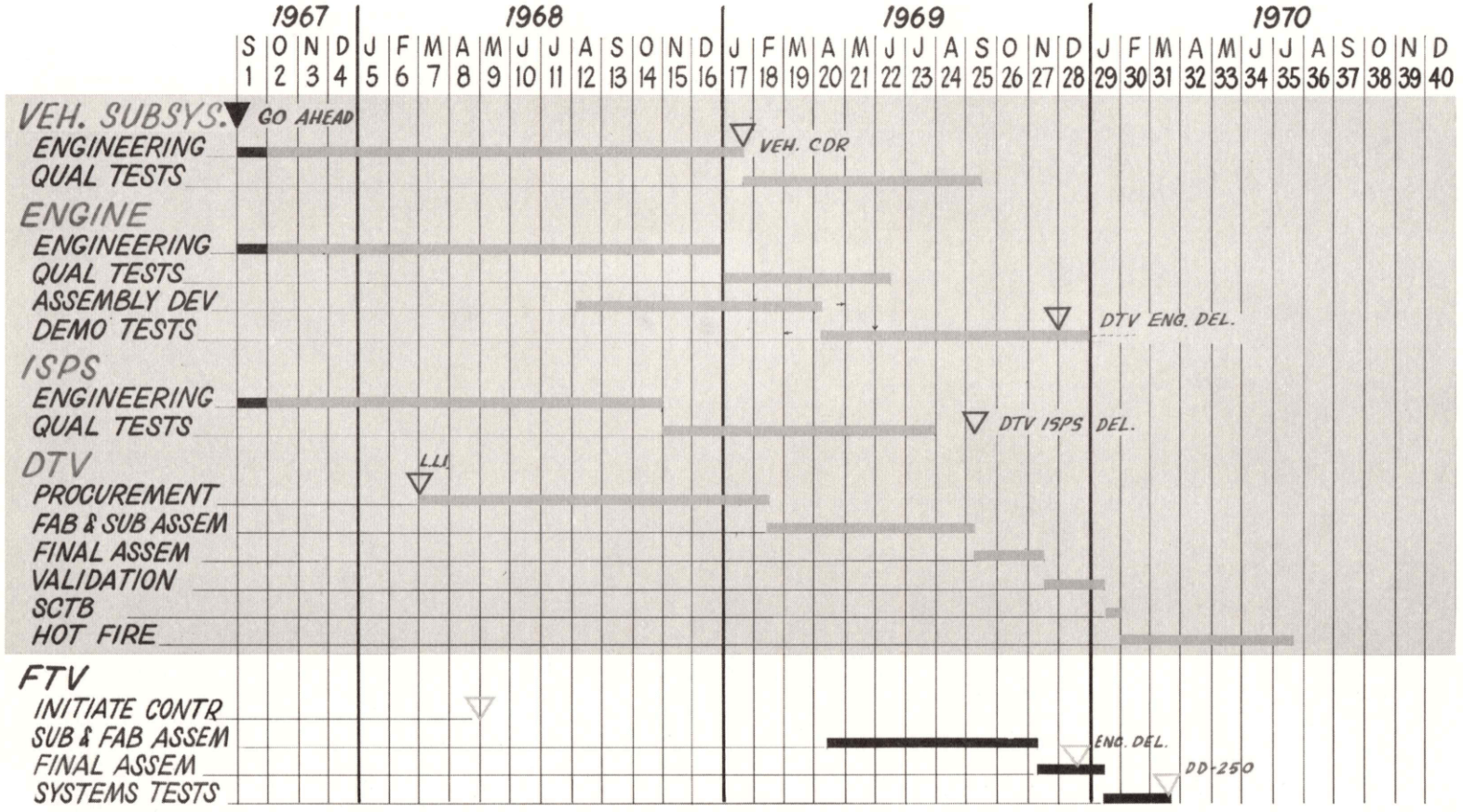


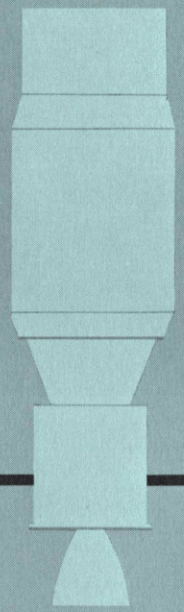
ON-ORBIT MANEUVERS

	TYPICAL VALUES F.P.S.	PROBABLE MANEUVER FREQUENCY
SECONDARY PROPULSION		
ORBIT CORRECTION	20-40	ONCE
DRAG MAKE-UP	2/5 - 5 PER ORBIT	ONCE PER DAY
DOCKING	≤ 300	ONCE
STATION KEEPING	1/5 - 2 PER ORBIT	ONCE PER DAY
PRIMARY PROPULSION		
PLANE CHANGE	400 PER DEG.	ONCE
ALTITUDE CHANGE	1/2 PER MILE	ONCE OR TWICE
PHASE CHANGE	BY ALTITUDE CHANGE	
DE-ORBIT	400-800	ONCE
SYNCHRONOUS EQUATORIAL INJECTION	6025	ONCE

IMPROVED AGENA

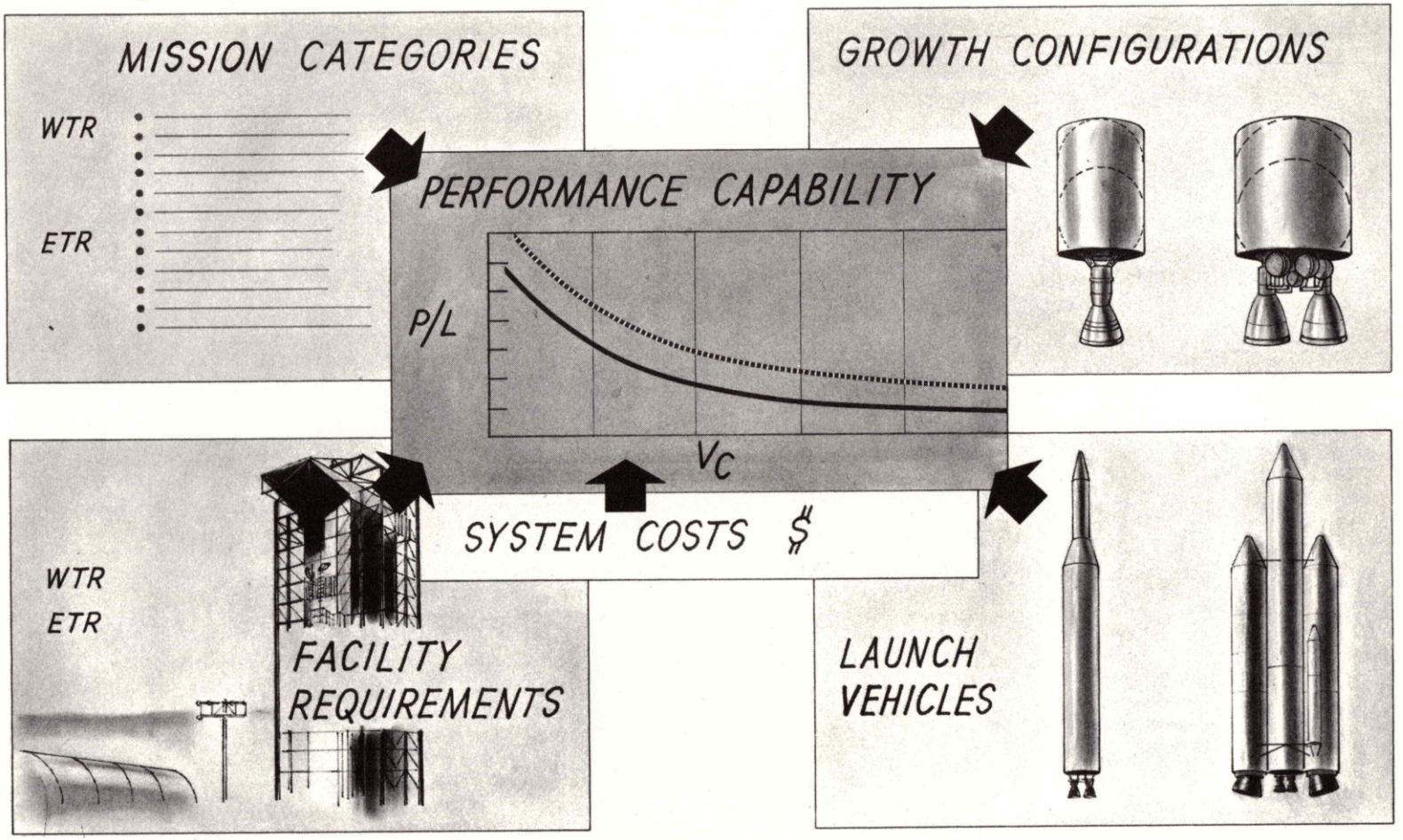
DEVELOPMENT SCHEDULE





GROWTH PROJECTION

GROWTH CAPABILITIES EVALUATION



ADVANCED REQUIREMENTS BASIS

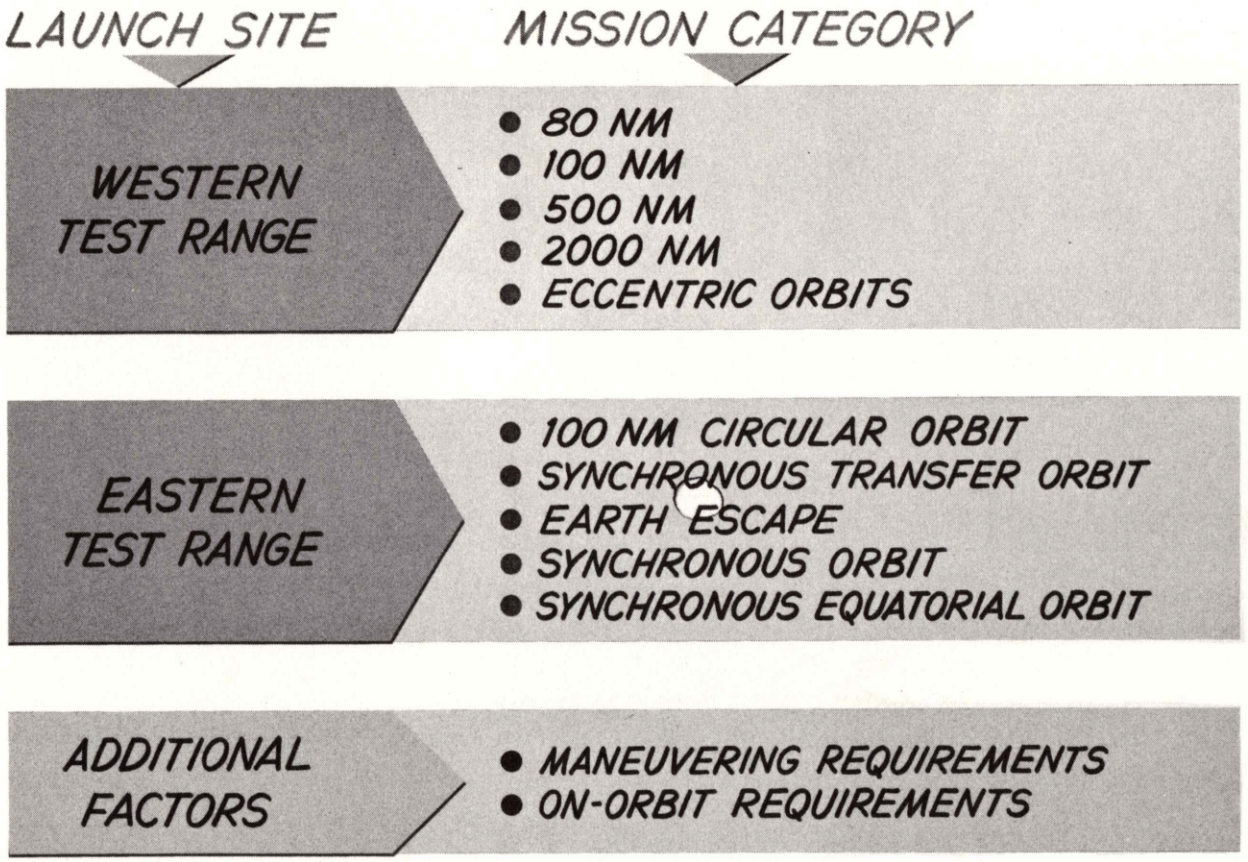
ASCENT VEHICLE TRENDS

- IMPROVED AGENA MATCHES SMALLER BOOSTERS
- IMPROVED BOOSTERS STIMULATE GROWTH
- HIGHER ORBITS AND MANEUVERING ΔV
- MORE ADAPTER AND SHROUD VARIATIONS

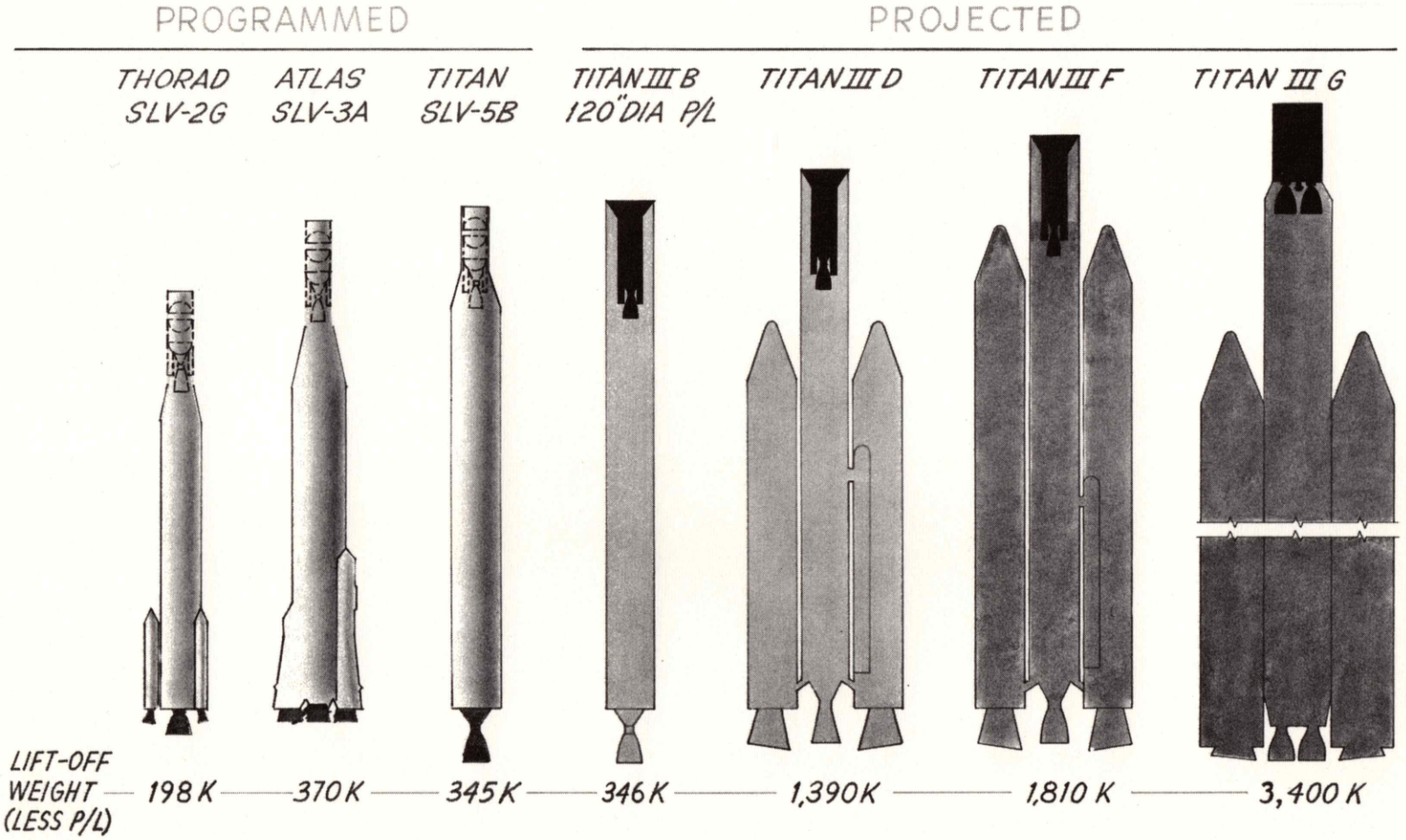
SPACE VEHICLE TRENDS

- MODULARIZED SUBSYSTEMS
- MANY SUBSYSTEM OPTIONS
- MODULE-CONCEPT IMPROVES RELIABILITY
- MISSION-PECULIAR EQUIPMENT RACKS

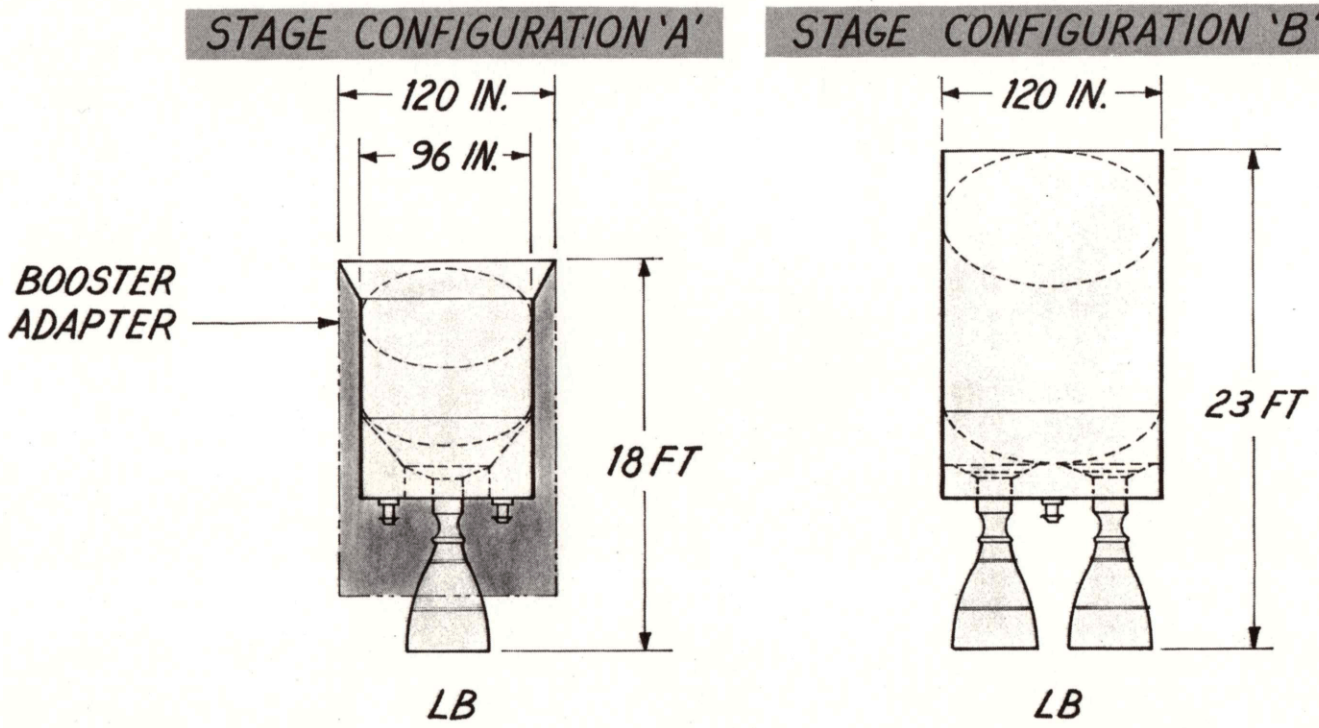
MISSION CATEGORIES



LAUNCH VEHICLE CONFIGURATIONS

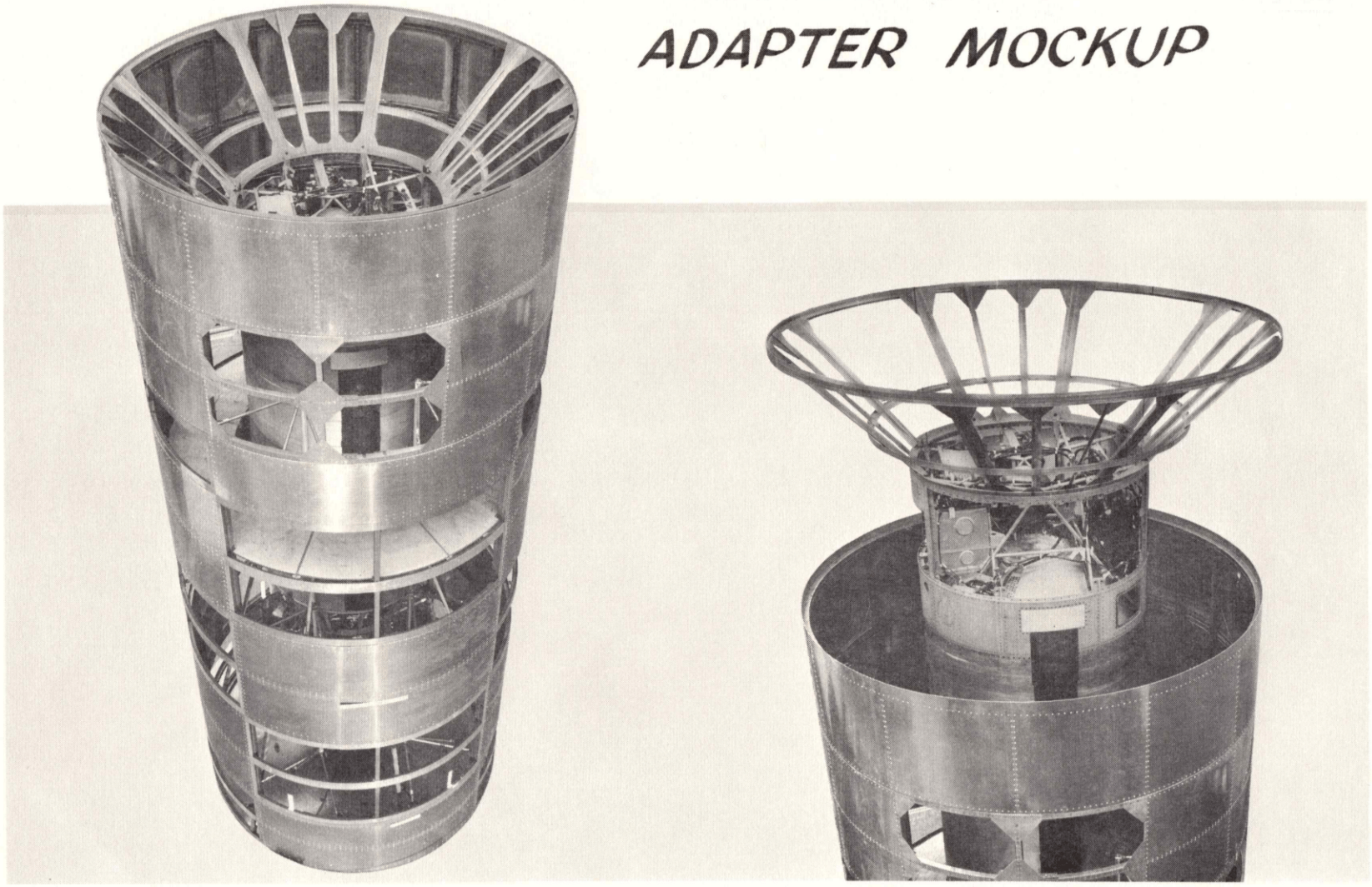


AGENA GROWTH CONFIGURATIONS

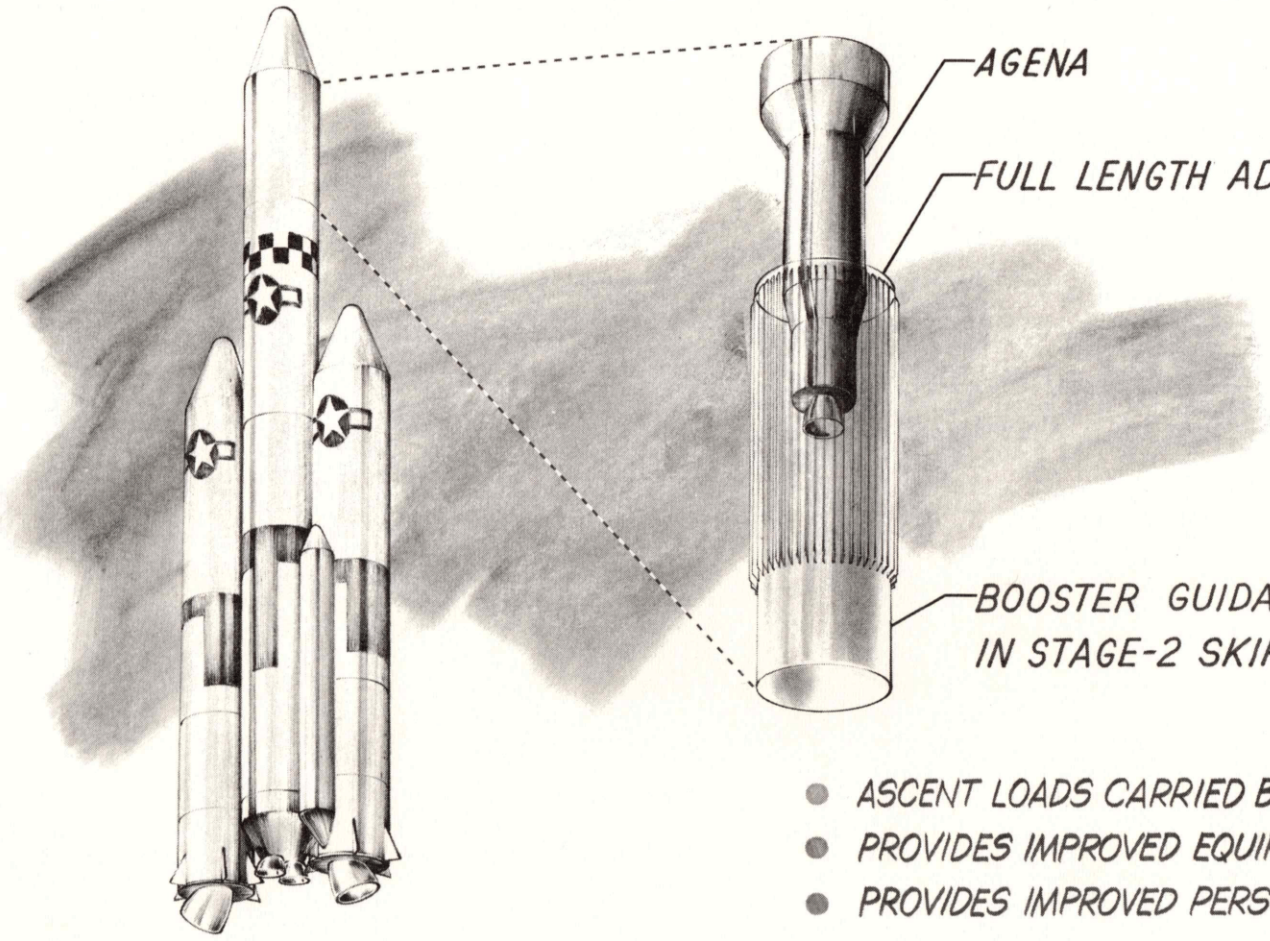


	LB	LB
PROPELLANT LOAD	30 K	70 K
INERT WEIGHT	1.8 K	3.9 K
VAC THRUST	18 K	36. K

FULL-LENGTH ADAPTER MOCKUP

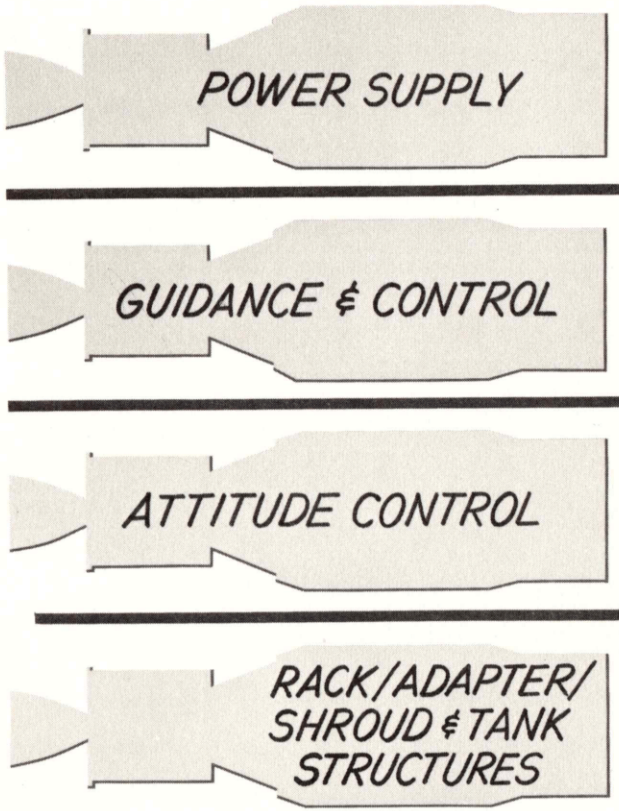


TITAN/AGENA FULL-LENGTH ADAPTER



- ASCENT LOADS CARRIED BY ADAPTER
- PROVIDES IMPROVED EQUIPMENT VOLUME
- PROVIDES IMPROVED PERSONNEL ACCESS

SUBSYSTEM IMPROVEMENTS



- HIGH ENERGY BATTERIES
- IMPROVED SOLAR PANELS
- FUEL CELLS

- IMPROVED INERTIAL GUIDANCE
- MULTIFUNCTION COMPUTER
- HIGH ALTITUDE HORIZON SENSOR

- HOT GAS SYSTEM
- DRAG MAKE-UP THRUSTERS
- CONTROL MOMENT GYROS

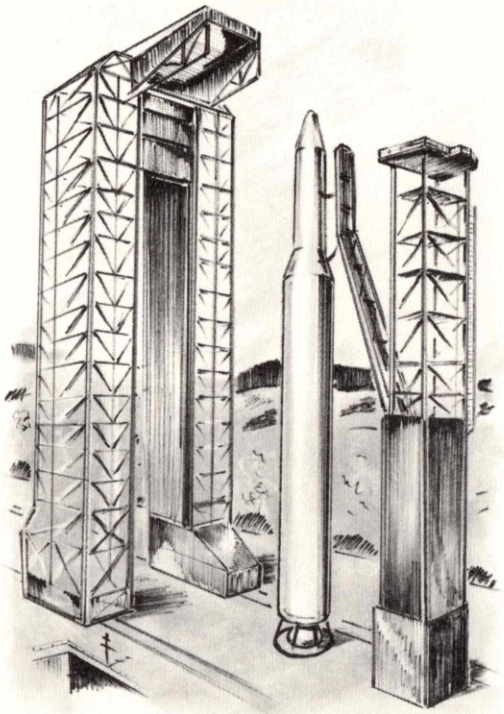
- IMPROVED MATERIALS AND CONSTRUCTION
- ADAPTER KITS FOR NEW CONFIGURATIONS
- IMPROVED PROPELLANT ENTRAPMENT DEVICES

LAUNCH FACILITY STATUS

BOOSTER NAME	BOOSTER MODEL NO.	OPERATIONAL PADS WTR	OPERATIONAL PADS ETR	PROJECTED PADS WTR	PROJECTED PADS ETR
THORAD	SLV-2G	SLC-1-E/W SLC-3-W	—	SLC-2-E/W	C-17 A/B C-12 OR 14
	SENIOR	—	—	SLC-1-E/W SLC-2-E/W SLC-3-W	C-17 A/B C-12 OR 14
ATLAS	SLV-3	SLC-3-E SLC-4-E	C-12 C-13	—	—
	SLV-3A	—	—	—	C-13
TITAN IIIB	SLV-5B	SLC-4-W	—	—	C-40/41
TITAN IIID/F	SLV-5D	—	—	SLC-4-E SLC-6	C-40/41
	SLV-5F	—	—	SLC-6	C-40/41

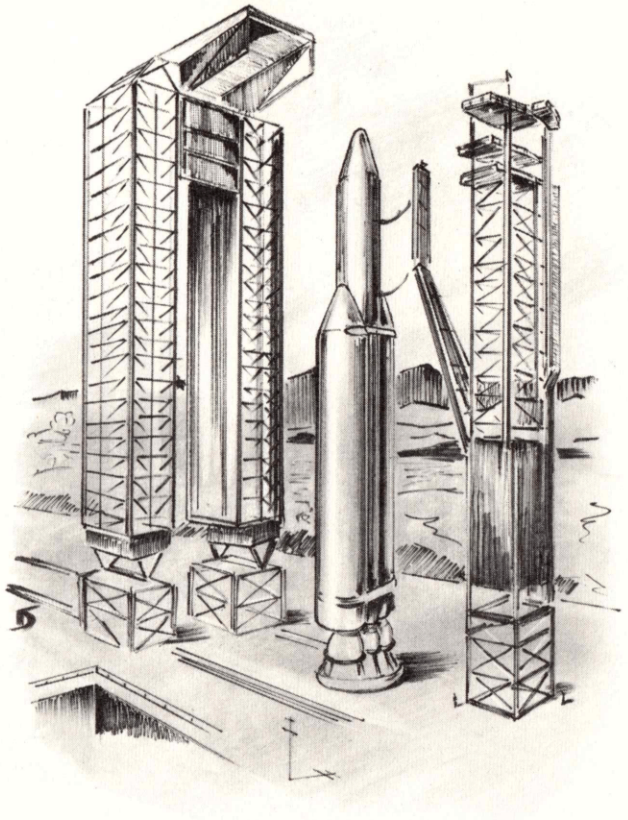
WTR TITAN III/AGENA AUGMENTATION

TITAN III B/AGENA



SLC-4-WEST
EXISTING

TITAN III D/AGENA

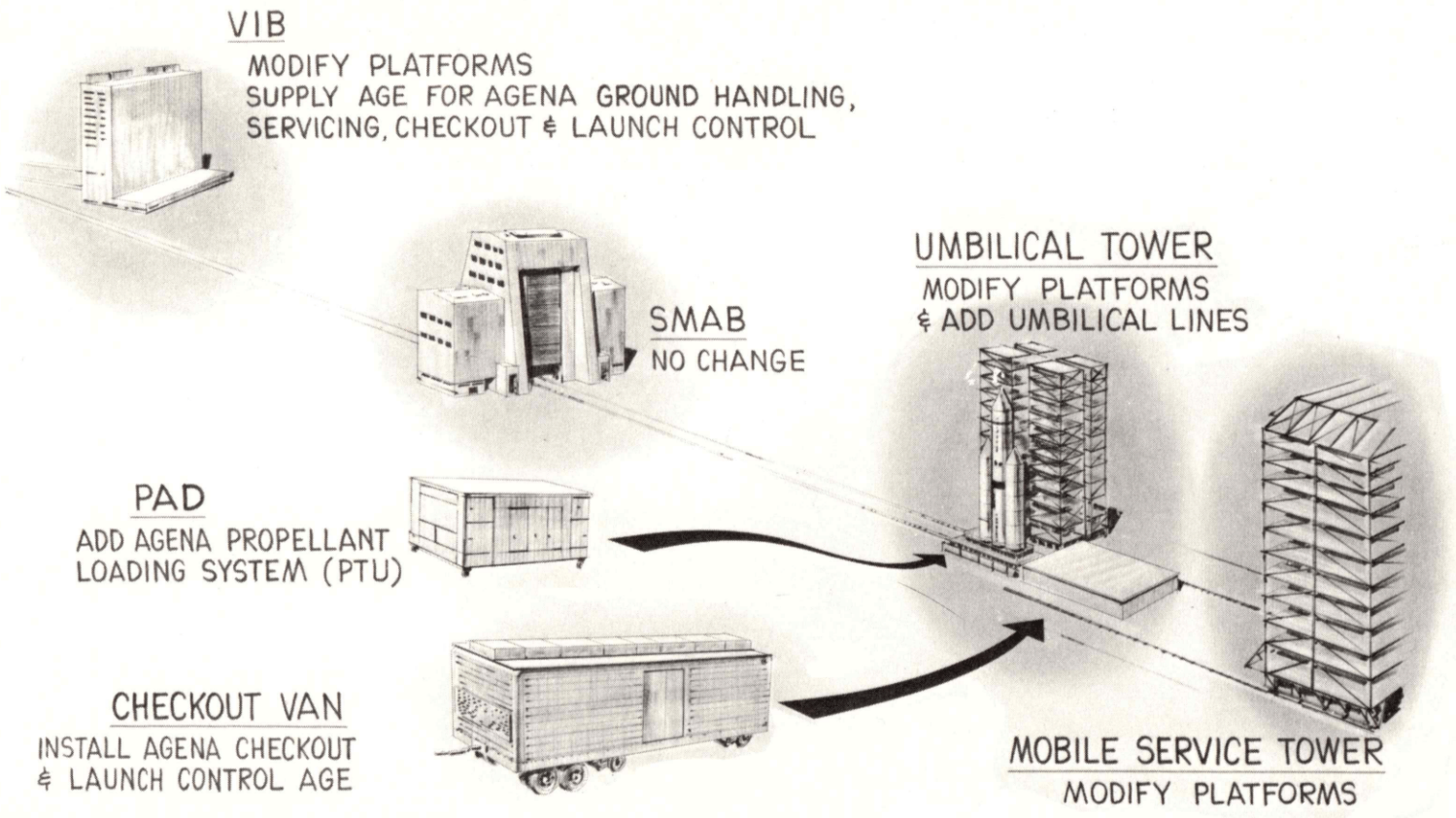


SLC-4-EAST (MODIFY)
SLC-4-NORTH (NEW)

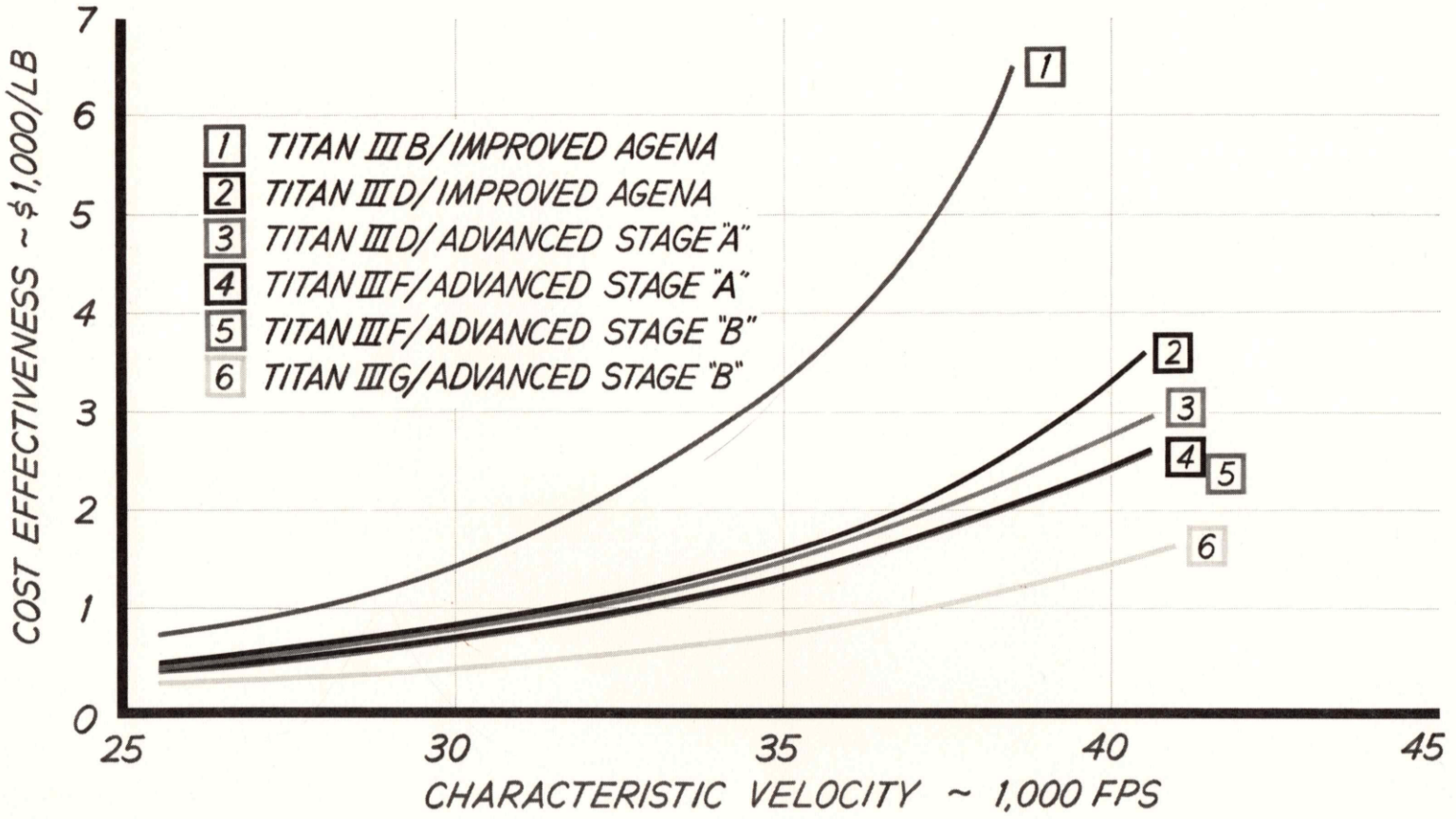
MODIFICATIONS

- RAISE UMBILICAL MAST
- STRENGTHEN & RAISE MST
- UPRATE GANTRY CRANE TO 50 TONS
- ADD NEW LAUNCHER
- NEW FLAME DEFLECTOR
- STRENGTHEN LAUNCH PAD BLDG. ROOF

LAUNCH FACILITY & AGE



COST EFFECTIVENESS COMPARISON



NOTE: BASED ON ETR EASTERLY LAUNCH AT 6 PER YEAR